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THE HUMAN SIDE
OF FABRE



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THE HUMAN SIDE OF FABRE

BY
PERCY F. BICKNELL

ILLUSTRATED WITH PHOTOGRAPHS



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TO HIS OLD FRIEND
WALDO R. BROWNE
WHOSE TIMELY SUGGESTION PROMPTED
THE WRITING OF THIS BOOK
IT IS GRATEFULLY DEDICATED
BY THE AUTHOR

PREFACE

In these days of narrow specialism it is broadening to the mind to make the acquaintance of an unrivaled specialist who is also a great deal more than a specialist. In college and university, if not also in our lower schools, it is too often true, as has been well said, that a fragment of an educator teaches a fragment of a subject to a fragment of a pupil.

The naturalist whose life is followed in these pages taught much more than a fragment of a subject. He was ever on the alert to discover and make known the larger meanings of little things. He tried to see life as a whole. He imparted human interest to his descriptions of insect habits, for he had a rich human nature of his own; and it is this quality that it has seemed best to emphasize in offering to his many admirers, in this centennial year of his birth, "The Human Side of Fabre."

Acknowledgments are due to Fabre's earlier biographers, Dr. G. V. Legros and the Abbé Augustin Fabre; as also to Dr. Leland O. Howard and Mr. Charles Buxton Going, who have given us vivid first-hand accounts of the naturalist's old home at Sérignan. But to Fabre himself, as self-portrayed in his "*Souvenirs Entomologiques*," the author is chiefly indebted for material. It is true that much of this material has already been used, one way

PREFACE

or another, in the many translated volumes bearing Fabre's name that have appeared in many languages; but as no lifelike portrait of the man is possible without generous quotation from his own works, apology seems hardly necessary here for reproducing passages that may not all be new to all readers.

It is hoped that this short biography, which is largely also an autobiography, will interest those who have found pleasure and profit in "The Story Book of Science," "The Wonder Book of Chemistry," "The Secret of Everyday Things," and the other volumes of Fabre's elementary science series; for these chapters out of the great naturalist's life have been told as far as possible in his own words and in his own simple and engaging manner. It is believed, too, that the book will appeal, as do the volumes just named, to older readers scarcely less than to their juniors. In fact, the subject is one that can hardly be made attractive to very immature minds; but it does have interest for the more serious the more reflective, of whatever age.

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THE HUMAN SIDE OF FABRE

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CHAPTER I

AS THE TWIG IS BENT

IT takes a wise man to know how little he knows, how little indeed it is possible for any one to know in comparison with all that there is to be known. The great naturalist whose life we are to follow in this book, and who always preferred to call himself a naturalist rather than an entomologist, was in fact much more than a naturalist; he was learned in many other ways, and he had also the wisdom that is much more than learning, the wisdom that made him say of himself, in almost the words of Socrates, another very wise man: "What I know best of all is that I know nothing."

As a matter of fact, the great French student of nature and lover of insects was perfectly at home in zoölogy, ornithology, entomology, botany, agriculture, horticulture, astronomy, chemistry, physics, physiography, microscopy, mathematics, and a number of other sciences; also he had no mean attainments in music, poetry, painting, drawing, and various handicrafts of a humble order. Hence it is that he is so interesting both as man and as writer; and the interest is greatly increased by his being, on the purely human side and apart from his learning

and accomplishments, a very gentle and lovable character. The pathos of his long struggle against adversity is matched only by the courage and persistency with which he held true to his high ideals. Fame and fortune were scorned by him as ends in themselves; and so fame, though late in coming, did at last come to him most deservedly and in increasing measure, and the modest fortune, or rather livelihood, desired by him as a means to worthy achievement, was not wholly denied.

Jean Henri Casimir Fabre, better known as Henri Fabre, was born in the little upland village of Saint-Léons, three thousand feet above sea-level, one hundred years ago, December 22, 1823. (There is some dispute as to the precise day of the month, but the date here given has the best authority.) His renown will some day put the place on the map, it may be hoped; but at present Saint-Léons will not be found in the ordinary atlas. It lies in the department of Aveyron, in southern France. It is high pasture-land of little fertility, but from those stony acres the parents and the earlier ancestors of the naturalist seem somehow, with the help of a few cows and sheep, to have wrung the means of subsistence.

To the peasant class, all but illiterate and with the narrowest outlook on life, belonged the family of our richly gifted and highly cultured historian of the insects. He tells us, in all frankness, that his grandfather on his mother's side, holding some small local office not unlike that of bailiff or process-server, could barely "scrawl on a sheet of official

stationery in a rudely primitive orthography," while his grandmother regarded the alphabet as a sort of "intricate puzzle good only for spoiling the eyes and wholly unprofitable except when put upon paper stamped by the government." The grandparents on the father's side had even less of polite learning. "People of the soil and having never in their lives opened a book, they were profoundly ignorant of the alphabet. They tilled a meager patch of ground on the cold granite ridge of the Rouergue plateau." Rouergue is the older name of what is now, in the main, Aveyron. It was to this hard-working and grimly matter-of-fact couple that Fabre's earliest memories went back, for under the grandparental roof, at Malaval, not far from Saint-Léons, he was reared from the age of about five years to that of seven. This arrangement was made in order that there might be one mouth the fewer to feed at home, where food was apparently none too plenty.

What most strikes one in this picture of the boy Henri is the singularity of his tastes and aptitudes as contrasted with those of the humble folk to whom he by birth belonged; for even as a small child he showed the inquiring mind and the love of nature that afterward made him famous. In his own person the future naturalist offered the clearest proof that ancestry and surroundings—heredity and environment, the scientist would say—do not necessarily determine what a person's character and gifts shall be. So much at least of the theory of evolution, a theory that he found much

reason to criticize in later life, he unconsciously refuted as a boy.

A few homely details to fill in the outline of those boyhood years will be all the more welcome here because they are sketched by the master himself in the "Souvenirs" written by him long afterward. He speaks of his grandfather's house as "standing alone amid broom and heather, with no other dwelling anywhere near it, and from time to time visited by wolves." For protecting the flock from these marauders a movable enclosure of wickerwork was used. As fast as one patch of pasture was grazed over, this light fence was moved on to the next, the shepherd's straw hut being trundled along with it. At night two trusty sheep-dogs, wearing collars studded with sharp spikes, stood guard over their sleeping charges. Except certain near-by villages where occasional fairs were held to which the calves from the farm were driven, the outside world was but little known, and that little was of the vaguest sort.

Here is a picture of the family at table:

"When meal-time came, we all, great and small, gathered about the long table and seated ourselves on pine benches, each bench being supported by four wooden legs. An earthen bowl and a tin spoon lay at each person's place. At one end of the table was the enormous rye loaf, as large around as a cartwheel, wrapped in a linen towel smelling not disagreeably of the lye in which it had recently been washed. From this loaf the grandfather, with one stroke of the carving-knife cut a piece

sufficient for the needs of the moment, and then with the same knife, which he alone was entitled to wield, subdivided this piece into as many equal parts as there were hungry mouths to feed. Each person then crumbled his share into his bowl in such fashion as best suited him.

“Next came the grandmother’s part. A big-bellied pot was hissing and bubbling over the blazing fire on the hearth. It sent forth a savory odor of turnips and bacon. Armed with an iron ladle plated with tin, she dished up, for each in turn, first a portion of the soup to saturate the bread, and then a good helping of turnips with a bit of bacon, half fat and half lean. At the end of the table opposite the rye loaf stood the pitcher of water for the unrestricted use of the thirsty. Ah, what sharp appetites we had, and how good the food tasted, especially when a white cheese, home-made, concluded the repast!

“At one side of the room blazed the wood fire in the enormous fireplace where, in very cold weather, whole tree trunks were burned. In a corner of this monumental fireplace, which was well coated with soot, there projected a slab of slate at a convenient height for holding the light used in the evening. This consisted of a blazing pine splinter, carefully chosen and well impregnated with pitch. It furnished only a reddish and smoky illumination, but served to eke out the slender supply of walnut oil that fed the wick of the crude lamp.”

When bowls had been emptied and the last crumb of cheese eaten, the grandmother would take her

distaff, seat herself on a stool by the fire, and spin with nimble movements of fingers and wrist, while her grandchildren crouched on their heels about her and held their hands to the cheerful blaze. To her fireside tales with which these occasions were enlivened her young auditors listened with all their ears, as we are told by our informant, who might have added, we suspect, that this delightful old grandmother was the original of the amiable Mother Ambrosine of "The Story Book of Science."¹ Both have an inexhaustible fund of stories, and both ply the distaff. Of the grandmother we are further told by Fabre:

"The stories she narrated to us were of little variety, it is true, but none the less wonderful and eagerly listened to, for in them the wolf always played a prominent part. This animal, the hero of so many tales that fairly gave us goose-flesh, I had a great desire to see; but the shepherd would never let me pass a night with him in the middle of the sheepfold."

And so the wolf remained a purely legendary character in these winter's tales. "When we had talked our fill about the terrible beast and about the dragon and the serpent, and when the last glow of red had died out in the pitch-pine splinter, we went to bed and slept the sweet sleep that follows a day of work. As the youngest of the household I was privileged to lie on a mattress, a sack stuffed

¹ Throughout the present volume the author in referring to Fabre's elementary science series uses the English titles.

with oat chaff, while my mates had nothing but straw for a couch."

To the teller of these animal tales, the grandmother who for two years was a mother to him, Fabre thus pays loving tribute:

"I owe you much, dear grandmother. It was on your bosom that I found consolation for my childish griefs, and it may be that you bequeathed to me a little of your sturdiness, a little of your love of work, though you were as much a stranger as my grandfather to my passion for insects."

He adds significantly:

"Not less so were my parents. My mother, absolutely illiterate, educated only in the school of hard experience, was the exact opposite of what the development of my aptitudes demanded in a mother. I would put my hand in the fire and take oath that the seeds of my character are to be sought for elsewhere. Did my father furnish them? No. A hard worker and of sturdy frame like my grandfather, the excellent man had received some schooling in his boyhood; he could read and could understand what he read, provided it was no more difficult than the anecdotes in the almanac." A good cuffing when the bug-hunting son was caught pinning an insect to a cork stopper was all the encouragement in entomology that the future naturalist received from this stern parent.

No, decidedly, he could not, in later life, find in heredity any explanation of his peculiar bent, so utterly opposed to all the habits and traditions of

his ancestors, good simple folk who revealed only a profounder ignorance and a narrower outlook the further back he traced his descent. "And yet," he declares, "from my earliest years the attentive observer, the curious inquirer, could be seen in me. Why should I not relate my first discoveries? They were of an extreme simplicity and ingenuousness, but none the less full of meaning as indications of subsequent tastes and aptitudes." He was still with his grandparents when these earliest researches in natural science were undertaken.

"There," he continues, "in the solitude of country life, amid the geese, the calves, and the sheep, came the first awakening of my perceptions. All before that time is to me impenetrable darkness. I was really born only with the dawn of life within, a sunrise dispelling the mists that precede self-consciousness and making a permanent impression on the mind. Even now I can see myself very clearly, clothed in a rough smock, its mud-stained hem flapping against my bare heels, and a handkerchief tied to my waistband with a bit of string—a handkerchief often lost by me and its office filled by the sleeve of my smock.

"One day I was standing lost in thought, my hands behind my back, my face upturned to the sun. The dazzling splendor fascinated me. I was as the moth attracted by the lamp. Was it with my mouth, I wondered, or with my eyes that I received such joy from that glorious radiance? That was the question propounded by my dawning curiosity in the things of science. Reader, do not laugh. The

future observer was beginning to use his faculties, was entering upon his first experiment. I opened my mouth wide and shut my eyes tight. The radiance vanished. I opened my eyes and shut my mouth. The radiance reappeared. I repeated the experiment, with the same result. That settled the question: I was convinced beyond a doubt that I saw the sun with my eyes. Oh, what a fine discovery! That evening I imparted my wonderful knowledge to the assembled household. My grandmother smiled indulgently at my simplicity; the others made fun of me. So goes the world.

“Another discovery. From a neighboring thicket of underbrush there used to come at nightfall a sort of clicking sound that attracted my attention. It sounded very faint and very sweet in the evening stillness. What could it be, I wondered. Was it the peeping of a little bird in its nest? I must find out, and that without delay. It was true that wolves from the forest came prowling around at that hour, as I had been told; but never mind, the urge was not to be resisted, and I was not going far—only behind that clump of bushes.”

Even at that tender age the untiring patience of the born investigator was beginning to show itself in Henri Fabre. Other and later instances of far greater significance and crowned with far richer rewards will be recorded in their proper place.

“I lay in wait a long time,” he continues, “but all to no purpose. At the least rustle of the bushes the clicking was sure to cease. I tried again the next day, and the next; and this time my persevering

vigilance brought success. Paf! My hand shot out and I caught the singer. It was not a bird, it was a grasshopper of the kind my playmates had taught me to turn to account by eating the upper and thicker portion of the hind legs—a scant recompense for my hours of ambush. But the best part of it all was not the pair of thighs with their crab-like savor; it was the knowledge I had gained. Thereafter I knew from personal observation that grasshoppers could sing! This time, however, I kept my discovery to myself, fearing I should be laughed at as I had been when I reported the results of my solar investigations.”

In this wise, as the naturalist in his reminiscent years was fond of recalling, the smock-clad, bare-footed urchin of six, with observant eyes ever open to the new and the strange in animal or plant, was all unconsciously training himself for his future work. The twig was being bent, and so would the full-grown tree be inclined. To the flowers of the field the boy was drawn as are the butterflies and the bees. He looked, examined, and made mental note of this and that, urged on by an insatiable curiosity that is not to be explained by anything in his birth or breeding. There was sprouting in him a seed hitherto unknown in his family; there was kindling a spark such as had never gone up from the hearth of his ancestors. Was this seed, this spark, to come to something in the future, or was lack of proper nursing and cherishing to bring it to naught? Time alone was to decide.

CHAPTER II

FIRST YEARS OF SCHOOL

SOMEWHERE in his many volumes of writings Fabre remarks that the common people have no history. Strangled by the clutch of the present, they cannot devote themselves to cherishing the memories of the past.

Luckily, though he himself belonged by birth to the common people, and rather gloried in the fact than felt ashamed of it, he fondly cherished the memories of his childhood and youth, and in what he has written of his own life he dwells upon these memories most delightfully. In fact, the past became to him in his later years more vividly real than the present.

"Clouded over by the vexations of the passing day," he declares, "the present, with all its trifling details, is not so well known to us as the past, glorified as that is with the radiance of childhood. In memory I see clearly what my young eyes saw actually, years ago; but what my eyes saw last week it would be impossible for me to recall with anything like the same distinctness."

Let us hear his own account, told with the vividness belonging to those early memories, of the village school to which he was sent, no reluctant pupil "creeping like snail unwillingly to school,"

at the age of seven, upon his return from his grandparents' to his parents' home.

"The time had come," he tells us, "for me to go to school, and things could not have arranged themselves better, for the schoolmaster was my godfather. How shall I call the room in which I was to make the acquaintance of the alphabet? The right word fails to present itself, for the apartment was devoted to all sorts of uses, being at once school-room, kitchen, bedroom, dining-room, and at times even hen-house and pig-pen. In those days educational palaces were unknown; any shanty would do for the teacher and his young disciples.

"From the school-room itself a wide fixed ladder gave access to the floor above, and under this ladder, in an alcove separated from the rest of the room by a board partition, stood a large bed. What was there in those upper regions? I never really found out. I used to see the master come down from there, sometimes with an armful of hay for his donkey, sometimes with a basket of potatoes which his housekeeper emptied into a kettle for cooking the dinner of the little pigs. The room overhead must, then, I concluded, be a sort of storage attic, a loft where provisions for man and beast were kept. These rooms comprised the schoolmaster's domicile.

"Let us return to the lower one, the school-room. It had one window, on the south side, the only window in the house. So low and narrow was it that a person standing before it could touch its lintel with his forehead and its jambs with his

shoulders. This sunny opening was the one cheerful spot in the whole house, and through it could be seen the greater part of the village spread out over the sloping sides of a funnel-shaped hollow. In the embrasure of this window stood the master's little table.

“In the opposite wall was a small recess where there met the eye the gleam of a copper bucket full of water. At this receptacle the thirsty were at liberty to refresh themselves at their discretion, a drinking-cup hanging there within easy reach. In the upper part of this niche, on some shelves, shone the tinware, the platters, plates, and goblets belonging to the household and never taken down from their place of honor except on high occasions. Scattered here and there on the walls, wherever a little light found its way in, hung crudely colored pictures. There one might see Our Lady of the Seven Sorrows, showing beneath her half-open cloak of blue a heart pierced by seven swords. Between a sun and a moon that looked at you with great round eyes was the Eternal Father, his flowing robe puffed out like a balloon, as if inflated by a tempestuous wind.”

Other similar works of sacred art adorned this temple of learning, and their brilliant splashes of red and blue and yellow drew the awe-struck gaze of the boy Henri. But we are told that the master had not supplied this gallery of art for his pupils' benefit, with a view to the forming of their minds and the elevation of their tastes. No, that would have been the last thing to enter the good man's

head. A lover of art according to his notions of art, he had embellished the room to suit himself, and his pupils were at liberty to profit or not by the embellishment, as they chose. The reminiscences continue:

“If this museum of penny paintings was a joy to me from one year’s end to the other, a still greater delight in winter-time, when unbroken cold and snow prevailed, was the great fireplace at the end of the room—a truly enormous fireplace in its generous proportions, and not unlike the one at my grandfather’s. Its vaulted cornice filled the entire width of the room, and the ample space of its cavernous depths was devoted to many uses. In the middle was the hearth for the fire, while on each side was a niche, half masonry and half carpentry-work, and these niches served as beds, each being provided with a mattress stuffed with chaff. Two boards sliding in grooves acted as folding doors and isolated the sleeper if he desired such seclusion. These two cubicles, snugly ensconced under the chimneypiece, constituted the dormitory of the privileged members of the household, the two boarding-pupils, and they must have been very snug and warm there on cold winter nights when the roar of the north wind made itself heard down the black chimney-flue and eddying blasts of snow filled the air outside.

“The rest of the fireplace was occupied by the hearth and its accessories—three-legged stools, salt-box hung against the wall to keep its contents dry, ponderous fire-shovel that took both one’s

hands to manage, and a blower like that through which I, with puffed-up cheeks, used to revive the dying fire on my grandfather's hearth. It consisted of a stout stick of fir-wood with a hole burnt through it from end to end. With this blower the operator could direct his breath from a distance upon the spot to be rekindled. On a couple of stones that served as andirons blazed the fagots provided by the master, with the stick apiece brought from home every morning by the pupils if they wished to enjoy the warmth of the fire.

“It was not exactly for our comfort, however, that this fire was maintained, but primarily to supply heat to a row of three kettles in which there simmered the concoction destined for the little pigs and consisting of a mixture of bran and potatoes. That was the real explanation of the cheery blaze, even though we were all expected to bring our morning offerings of fuel. With the two boarding-pupils seated on stools in the choicest places, and the rest of us squatting on our heels, we formed a semicircle in front of the big kettles, which, full to the brim, sent out occasional little spurts of steam with a sound of *poof, poof, poof*. Every now and then, when the master was looking in another direction, some of the boldest of our number would select from the nearest kettle a potato done just to a turn and harpoon it with the point of a jack-knife. The precious capture was added to the fortunate possessor's ration of bread; for it must be recorded that if in our school we worked little we ate much. It was our custom, as we wrote our page

or did our sums, to relieve the tedium of these tasks by cracking nuts and munching our crust of bread.

“Besides the satisfaction that came from a well-filled mouth as we bent over our books, there were for us smaller boys two other sources of agreeable distraction. The door at one end of the room opened upon a barn-yard, where the domestic hen, surrounded by her brood of chickens, scratched on the dunghill, and where the little pigs, a dozen in number, splashed about in their stone trough. This door often opened to let some youngster out, and the privilege of exit was freely abused by us. I say the door often opened, but the mischievous ones among us took good care not to close it; and pretty soon there would come trotting in a file of young porkers attracted by the savory odor of the steaming potatoes. The bench whereon sat the smaller pupils, myself amongst them, was against the wall under the copper bucket from which we quenched our thirst after prolonged indulgence in walnuts; and this bench lay exactly along the route of the porcine procession. It made its entrance with little grunting noises, each small animal followed by its tightly curled tail. The pigs rubbed against our legs, they poked their moist and rosy snouts into our palms for a last bit of crust, and their bright little eyes seemed to ask us whether we had not in our pockets a few withered chestnuts for them to crunch. After this exploring expedition in one direction and another, they would make their way out again into the barn-yard, gently expedited by the master’s handkerchief.

“Then came the hen bringing for our inspection her downy brood, all soft and velvety. Each one of us eagerly offered a few bread crumbs to these pretty visitors. We vied with one another in courting their favor and in caressing with tip of finger the soft down that covered them. School life, as the reader will perceive, was for us not without its moments of diversion.

“But what could we have learned in such a school as that? Let us speak first of the very youngest pupils of whom I was one. Each of us had, or was supposed to have, a little penny primer printed on gray paper and intended to teach the alphabet. First of all, on the cover, was the picture of a pigeon, or something meant to represent a pigeon; then came a cross, and after that the letters of the alphabet in their order. Turning the leaf, we were confronted by the terrible *ba, be, bi, bo, bu*, the reef on which the greater number of us were wrecked. Having at last mastered these difficulties, we were supposed to know how to read and were admitted to the company of the older boys.

“In order to profit properly by our little primer we needed at least some small portion of our school-master’s attention; we needed to be shown how to go to work to fathom its mysteries. But the good man had no time to give us, occupied as he was with the more advanced pupils. The famous manual with its pigeon and its alphabet was put into our hands solely to give us the appearance of pupils. We were left to pore over it, if we chose, on our bench, and to puzzle out some small portion of its

meaning, if we could, with the help of an obliging neighbor, when by chance it proved that the obliging neighbor knew one or more letters. Our meditations did not advance us very rapidly, however, interrupted as they frequently were by stolen visits to the potato-kettles, disputes among ourselves over the possession of a marble, the noisy intrusion of the pigs, or the entrance of the hen and her brood. With the help of these various distractions we managed to possess our souls in patience until the hour came for our dismissal, which was for us the most important business of the day."

The older scholars, we further learn, practised the noble art of writing, and to them was allotted the scant daylight that struggled in through the one narrow window of the room. But not so much as a drop of ink was furnished by the school, each pupil being expected to provide his own writing-outfit complete. This consisted of the same crude items that Rabelais had told about centuries before, namely: a long pasteboard box divided into two compartments, the upper one containing the pens, which were turkey or goose quills cut with a penknife, and the lower holding a small bottle of ink made of soot stirred up in vinegar. To the master fell the important office of trimming the pens, a delicate operation and not without danger to inexperienced fingers; and his also was the high duty of setting the copy, of heading the page with a series of simple strokes for the beginners, of separate letters for the more advanced, and of whole words for the extraordinarily proficient. That done, the admiring gaze of his awe-

struck pupils followed his execution of a wonderful specimen of graphic art. First a few preparatory flourishes without touching pen to paper, the hand supported merely by the little finger; then a bold dash, a rapid whirling motion, and there was left on the sheet a garland of loops and spirals and corkscrews enclosing a magnificent bird with spread wings—all this, please observe, in red ink, the only medium worthy of so skilled a pen. Both little and big in the school-room sat awe-struck before such marvels. In the evening, at home, the masterpiece would pass from hand to hand, calling forth appropriate exclamations of amazement. “What a man,” one would remark to another, “to be able, without once lifting his pen from the paper, to draw you a Holy Ghost like that!”

What, we may ask, did little Henri Fabre and his schoolmates have as a reading-book when they were at last promoted from the penny primer that was supposed to teach them the alphabet? In French they had scraps of sacred history, but Latin was oftener served to them, to enable their young voices to join in the vesper chants. The most advanced among their number even went so far as to grapple with the difficulties of manuscript, the deciphering of some deed of sale, perhaps, in the clerkly hand of the village notary. And what of secular history, and of geography? Not a word was ever heard of them. What did it matter whether the earth was round or square, a sphere or a cube? Its shape made no difference with the grim problem of making it yield the wherewithal to sustain life.

Grammar was equally unknown. The master troubled himself with it very little, and his pupils still less. Noun, adjective, verb, adverb—these and other grammatical terms would have been as words in a foreign tongue to those little lads. Correct speech was just a matter of usage, to be learned by keeping one's ears open; and what was the use of all these linguistic niceties when, as soon as school was over, one had simply to go back to the barn-yard and the sheepfold and the cabbage-patch? Arithmetic, on the other hand, was held in considerable esteem, though the word itself was seldom heard. One learned how to reckon, to write down numbers, if they were not too long, to add and subtract, and, on Saturday afternoons, in celebration of the end of the week, there was oral practice in multiplication. Very much as in our American district schools Friday afternoon used to be memorable for its spelling-matches, the whole school taking part in two opposing sides chosen each by a captain or leader and striving mightily to spell each other down, so in this little French country school Saturday afternoon was given over to multiplication matches, or multiplication choruses they might better be called.

First the smartest scholar rose and in a high-pitched voice recited the opening line of the multiplication table, a table that ended with "twelve times twelve," as the duodecimal system of French weights and measures had not then given place to the decimal. At the end of each line the whole school, little tots included, took up the refrain in deafening chorus, making such a hullabaloo as to send pigs

and chickens scurrying for safety to the quieter regions without. By dint of these vocal exercises, this good and wholesome lung-expanding drill, the multiplication table was hammered into the pupil's mind as was no other part of the curriculum. But this does not mean that the school turned out accomplished mathematicians. Most of its graduates easily lost their way when it came to "carrying" a figure in the process of multiplying on paper, and very few ever fathomed the mysteries of long division.

But, after all, the dominie was an excellent man, as his subsequently distinguished pupil cordially acknowledges, and all he needed in order to become an able instructor was the requisite time to devote to that office. His functions in the village were too many for any one person to perform properly. He acted as steward to an absentee landlord, as choir-leader in the church, bell-ringer on all occasions calling for such service, such as christenings, weddings, funerals, and the averting of an impending storm; also as barber to the curate, the mayor, the notary, and other local dignitaries, and as winder and regulator of the village clock. This last office was one of dignity and honor. Climbing the clock-tower, he would make his way into the wooden cage containing the machinery of which he alone knew the mysteries, and then, with a calculating glance at the sun to determine roughly the time of day, he would set the hands and wind up the weights.

CHAPTER III

BOYISH PRANKS AND PASTIMES

IN such a school and under such a teacher what hope was there for the development of little Henri Fabre's peculiar genius? Was the seed to perish in that apparently unfavorable soil? No, its germination was, on the contrary, aided in the most curious fashion. The boy had eyes to find what he needed, he saw what it was in him to look for. The rude woodcut of a pigeon on the front cover of his primer was studied by him far more earnestly than the ABC under that cover.

The bird's round eye, he tells us, with its encircling scalloped ring, seemed to smile on him. Its wings, every feather of which he carefully counted, spoke to him of soaring flights among the beautiful clouds, transported him to the beech woods where the smooth tree-trunks rose in graceful slenderness from a mossy carpet dotted with white mushrooms looking like eggs laid there by some vagrant hen, and carried him to the snow-capped mountaintops where the bird left the star-shaped imprint of its red claws. To his innocent eyes that crude pigeon was a magnificent creature, abundantly compensating him for the trials and tribulations that followed upon opening the book. Thanks to the

pigeon, the embryo naturalist conducted himself very properly on his hard bench and waited without too much impatience for the hour of dismissal.

When in summer the master, somewhat after the manner of Mr. Squeers in "Nicholas Nickleby," took his young charges with him to help him in his work of tidying up the grounds of the absentee landlord whom he served as steward, Henri was of the party. But he was loath to crush, as he had been told to do, the snails in the hedge, so beautiful did they appear to him in their varied coloring, yellow and red and white and brown, and all enclosed in such enchanting spiral shells. His habit was to fill his pockets with the choicest specimens for future enraptured contemplation. And in the haymaking in the schoolmaster's meadow the lad was far more interested in butterflies and beetles than in the harvesting of fodder for the good man's cow. The narcissus, too, with its drop of honey to be gathered on the tip of a carefully inserted tongue, gave him joy even though it gave him a headache at the same time if its fascinations were yielded to without restraint. Crickets also were his delight, and who knows how many more of the insect tribe met with in the fields where he spent so many of his idle hours, as one might mistakenly call them, in the long summer of southern France?

One day the happy thought occurred to the parents of our young student of nature to turn those idle hours to profitable account by placing the boy in charge of a brood of ducklings. The raising of the ducks might, it was hoped, put a few francs into the

family purse, where they were sorely needed; there was no doubt of that. Accordingly, to his great delight, the little lad found himself installed as keeper of a promising family of ducklings. But there was no duck pond in the near neighborhood, and when the possibilities of a half-filled wash-tub in the dooryard had been outgrown by the web-footed company, the only thing to do was to resort to a distant mud-hole, or perhaps it might better be called a miniature swimming-pool. To this apology for a pond the young duck-herd and his charges made their rather wearisome way each morning, and thence they returned, all more or less footsore and with limping gait, each evening. To beguile the time while the ducks splashed and quacked and regaled themselves with such small aquatic prey as they could find, their guardian explored the shallows and collected specimens, entomological, botanical, and mineralogical. A brilliant blue beetle was first put for safe-keeping into an empty snail-shell, the mouth of which was stopped with a leaf, and the whole then went into the collector's pocket, to be taken home for more leisurely inspection. Various pebbles of wondrous hues were also eagerly pocketed. Some sand that glittered as with particles of gold made its irresistible appeal as another bit of treasure-trove. And so on, until pockets were sagging and rents began to testify to the weight of all these accumulated riches.

"You little good-for-nothing!" exclaimed the irate father at sight of his young hopeful's rather comical plight when the small duck-herd came driving

his limping poultry home at nightfall. "I send you out to tend ducks, and you spend your time gathering stones, as if we had n't more than enough of them already, all about the house. Throw the trash away, this minute!" And so gold and diamonds and resplendent beetles went on to the dust-heap.

"To bring up one's children and then see them turn out so badly!" lamented the mother. "You will be a reproach to your poor parents. If you must cram your pockets, let it be with green stuff; that will help feed the rabbits. But stones and all sorts of little animals that are likely to poison your hands—what do you mean by bringing such things home with you, you little simpleton? It must be that some one has cast an evil spell over you."

Ah, yes, the boy in later years, struggling against adversity, was often ready enough to believe himself under the influence of that evil spell!

Another memory of childhood is that of the ash-tree under which his little heart beat so excitedly one sunny morning in spring when he had just discovered, tucked away amid the dense foliage, a sort of white cotton-like ball with a tiny red-capped head peeping over the top of it in an attitude of disquiet and apprehension. Incomparable find! It was a goldfinch's nest and the mother was sitting on her eggs.

Still another fond reminiscence of a similar kind goes back to the day when, rich in the possession of an apple for his lunch, and with the whole day before him in which to do what he liked, he proposed to climb to the top of a distant hill whose crest stood

out against the eastern sky in challenging fashion. It had cut off his view long enough, and now the young explorer was determined to see what lay beyond. How often, on stormy days, he had watched from the little window at home the trees that topped the hill bending and swaying in the wind! How he had marveled at their suppleness of trunk and limb! He had rejoiced with them when calm weather gave them a period of quiet, and had been distressed at their gestures of remonstrance and alarm in boisterous gales. They were his friends, the sun rose from behind them every morning, and he wished to know whence it came. Therefore he would climb up, take a look over the crest, and perhaps find out.

But the way turned out to be much longer than it had appeared, the grade was steep, like the roof of a house, and the explorer's legs were short. From time to time he lifted his eyes and surveyed the prospect, but the trees did not seem to come any nearer. Then, of a sudden, something almost under his feet attracted his attention. A lovely bird had flown up from under the shelter of a large stone, and there—oh, wonder of wonders!—was revealed a nest of horsehair and fine straw. It was one of the earliest of the many joys the finder was to owe to birds. In the nest were six sublimely beautiful blue eggs, looking as if they had taken their tint from the azure of heaven. With the cruelty of thoughtless childhood the lad determined to come back in a fortnight and get the brood; but meanwhile he would take one of the eggs, despite the anxious mother's repeated protests.

No more hill-climbing for that day. The fragile treasure must be carried home with such speed as safety permitted. At the foot of the hill the vicar, reading his breviary as he walked, was encountered.

"What have you there, my boy?" he demanded, noting that the urchin held something hidden behind his back.

In confusion the culprit displayed the stolen egg, resting on a bit of moss in the palm of his hand.

"Ha, a stonechat's egg! Where did you get it?"

"Up there, under a stone." And the whole story followed, little by little, in response to the kindly vicar's questioning—how the nest had been discovered by accident when something quite different was the object of the boy's quest, and how he was going back for the young birds as soon as their feathers were grown.

"My little lad," remonstrated the holy man, "you surely will not do that; you will not rob the mother bird of her young; you will take pity on the innocent things and let them grow up and fly away as the good God intended. They are the joy of the country-side, and they rid the soil of harmful insects. So be a good boy and don't touch the nest."

The promise was given, the vicar continued his walk, and the other returned home with two fruitful seeds sown in the fresh soil of his young mind—the suggestion that it was wrong to rob a bird's nest, and the novel idea of names being attached to the members of the animal kingdom just as they are to those of the human family. Stonechat! Why, that must have something to do with the bird's liv-

ing and nesting among stones! Some years later, when Latin had been added to the young naturalist's acquirements, he recognized the appropriateness of the bird's learned name, *saxicola*, and his mind went back to that thrilling discovery on the hillside and to his subsequent talk with the good vicar.

Among the most fondly cherished of these boyhood memories was that of the little garden at home, a patch of ground thirty paces long by ten wide, with a retaining wall on each of the long sides, for it was situated on the slope of a steep hill. Above it was a ruined castle with four turrets inhabited by pigeons. Other terraced gardens lay below this one, but none above it. A single apple-tree, a bed of lettuce, one of turnips, and another of cabbages—that constituted the garden, for there was no room for anything more. But against the upper retaining wall there trailed a grape-vine, and in some years, if the season had been favorable, "half a basketful" of white muscat grapes was gathered. That was a luxury envied by all the neighbors, for nowhere in the village except in that one sun-exposed spot was it possible to grow muscat grapes.

On the side toward the lower retaining wall grew a row of currant-bushes, which served as the sole protection against falling down the frightful precipice into the notary's garden adjoining. There, when no parental eye was upon them, Henri and his brother Frederic, two years his junior, would lie on their stomachs and peer down into the forbidden land. At the foot of the wall, which bulged out under the pressure of the retained soil, could be

seen the fine array of the notary's flower beds and fruit-trees. It was all a paradise of spacious delights—so much larger than the Fabre garden! Especially tempting were the pears that, in their season, hung, so tantalizing to the view, on the trees whose tops were level with the home grounds. Splendid pears they were, too, after they had ripened on straw until late in the autumn. And there was a walnut-tree, with bee-hives at its foot, the bees presenting the appearance of red smoke as they swarmed about their domicile. But, though the hives and the honey were unquestionably the notary's, the walnut-tree sent some of its roots into the soil belonging to his neighbor; and so the boys claimed some of the nuts. Getting astride one of the limbs that reached out as if in invitation, the older brother, Henri, would advance, slowly and fearfully, to a position where nuts could be reached and gathered. If the limb should break or the boy should slip, there would be a story of broken bones and angry bees to relate afterward. But the limb held and the boy did not slip, and the nuts were gathered with the help of a forked stick, after which came the return journey, backward, with bulging pockets and a breast swelling with triumph. Ah, those golden days of nimbleness and audacity when, for a handful of nuts, one laughed at the abyss and boldly trusted one's life to a swaying branch!

Like all boys in all lands and all ages, Henri Fabre was fond of apples, and their flavor was not

at all impaired by their being stolen fruit. "From time immemorial," writes the mature man, "the apple has been the small boy's delight, especially when it is plucked from another person's tree." So it came about that his pockets were not seldom stuffed with this tempting fruit from the outlying orchards.

Finally, to end this chapter, let us listen to Fabre's account of a rather peculiar amusement of his childhood, probably less familiar to country boys of our own day and our own land. "Still another diversion," he says, "was indulged in by us. Flocks of turkeys were not rare in our neighborhood, straying at random about the farms and snapping up the unwary cricket. If no one in authority was watching, they afforded us fine sport. Each boy would catch a turkey, put its head under its wing, sway the bird gently to and fro in this position for a few moments, and then lay it on its side on the ground. The bird would not budge. The entire flock of turkeys, subjected to this treatment, would at last lie motionless on the grass, presenting the appearance of a battle-field strewn with the dead and the dying. And then, look out for the farmer's wife! The squawking of the protesting victims before being hushed in slumber had not failed to reach her ears and tell the tale of our mischievous prank. Armed with a whip, she hastened to the scene; but our good legs were more than equal to the occasion. What shouts of laughter then, from behind a sheltering hedge! Oh, happy time of turkey-hypnotizing!"

Little did the young hypnotist then dream that

one day, years later, this experience would help to explain to the learned entomologist the habit many insects have of lying motionless—"playing dead" we call it—upon being shaken to the ground from their support on leaf or twig. In reality, as Fabre clearly proves in a most interesting chapter on his "Souvenirs," there is no feigning of death on the insect's part. Their unusual position, the falling so as to alight on the back, induces temporary unconsciousness; and that is all there is to the little creature's supposed cunning in assuming apparent lifelessness in order to repel such foes as refuse to touch dead game.

CHAPTER IV

LATER SCHOOL YEARS

WHEN Fabre was about ten years old the family moved to the neighboring town of Rodez, where the father, "the first of his line to yield to the temptations of a city," tried his unpractised hand at running a restaurant, with little enough success. Here the boy attended school for four years, helping to pay his way by rendering certain services in the college chapel (for the school enjoyed the dignity of a rather high-sounding name, *lycée*, or college in our language). This office of serving-boy entitled him to free tuition as a day scholar. Here at Rodez, as at Saint-Léons, it was animal and plant life that interested him far more than the studies of the course, which included no natural science of any sort. When, in due order, he took up Virgil and began to read the "Georgics," he was charmed with the description of animals and plants familiar to him.

Thus passed four more years of boyhood, and then came another change of scene: the family moved again, this time seventy-five miles to the southwest, to Toulouse, where the father once more tried his luck at restaurant-keeping, and once more failed to achieve brilliant success. Indeed, to the

end of his days he seems to have needed, and to have received, all possible help from his two sons. So we see that at no time was the future naturalist in danger of being spoilt by having his way made too easy for him. At Toulouse he was admitted without charge to the local academy, or seminary, as it was called. But his studies were soon interrupted by a third removal of the family, to Montpellier, almost on the Mediterranean coast, near the mouth of the Rhone. Here there was some thought of his studying medicine, for which he was by temperament and abilities admirably fitted. But, fortunately for himself and for the world, as it now appears, nothing came of it, as he was forced by continuing ill fortune to bid farewell for a time to his studies and earn his living by any means that offered. At one time we find him peddling lemons at the fair held at Beaucaire, or in the public market of Montpellier, or in front of the neighboring military barracks; and at another we see him enrolled with a company of workmen constructing a railway between Beaucaire and Nîmes.

In these dark days of grinding drudgery he was sustained by his love of nature and his eagerness to learn. Books were his delight when he could get them. One day he dined frugally on a few grapes in order to buy a copy of the poems of the baker-poet Reboul, and in reciting the verses of this obscure writer he forgot the pangs of hunger. He would make friends, too, with any small animal encountered in his day's work, and, if he chanced upon

an insect new to him, the day was made memorable by the event. Such a discovery was the pine-tree June-bug, a handsome beetle with a black or dark chestnut costume dotted with white velvet spots. He noted with interest the protest it made on being grasped with the fingers, a protest that sounded very much like the vibration of a pane of glass when rubbed with the moistened ball of one's finger. In after years he was to study this magnificent insect more closely and write down the results of his study.

Amid this confining and irksome toil, this heavy labor of the hands while the eager young mind was engaged in far other pursuits, the ambitious student found an opportunity, or made one, to compete for a free scholarship at the Primary Normal School of Avignon, an institution below the standard of our junior high school of to-day, but offering then about the best in the way of education to be had by boys of Henri Fabre's class. Spelling, arithmetic, and geography were the chief studies, and there was then little else deemed of enough importance to occupy the pupil's time and energies. No one at that time thought of including the study of nature in the prescribed course. Natural history led nowhither, opened the way to no career, it was asserted. But when the boy Fabre won the coveted scholarship, as he did at the first trial, he by no means felt himself bound to devote all his time and thought to the dreary round of spelling, arithmetic, and geography. While his mates were writing out their simple

exercises he was more often than not engaged, under the cover of his desk, in exploring the mystery of the wasp's sting, in dissecting some new flower, or in the enraptured perusal of a volume of poetry. Verses of his own making, too, were scribbled on loose sheets at this time, and a great number of these have been preserved, though but few have as yet been published.

It was not strange that, with his heart so little in the dry studies of the course, the winner of the free scholarship should have disappointed his teachers' expectations of him. In the middle of his second year at the school he was pronounced to be lazy, backward, and of only moderate intelligence. Stung to the quick by this ignominy, he asked to be allowed to redeem himself by cramming all the studies of the third and last year into the remaining half of his second year, in addition to the studies of that half-year. The request was granted, and so strenuously did the "lazy" lad apply himself that at the end of those few months of probation he triumphantly passed all his examinations and received his diploma.

Eighteen years of age at this time, he gave place to his brother in the school and fared forth to put his book-learning to some practical use. That brother, Frederic, it may be well to add here, was devoted to Henri, who for many years helped him up the rugged slope as fast as he himself climbed it. The younger brother patterned after the elder until, on reaching mature manhood, an increasing dissimilarity of tastes caused a divergence in their paths,

the older brother choosing the quiet walks of nature-study and of school-teaching, while the younger took upon himself administrative duties and assumed the cares and responsibilities (and emoluments) of public office. A bit of advice from the elder to the younger is full of meaning as showing the naturalist's method of approaching all intellectual tasks, a method that made him an unusually well-educated man, though largely self-educated. Writing to Frederic in 1851, he offers helpful counsel on the best way to learn Latin.

"Take your Virgil," says he, "a dictionary, and a grammar, and translate from the Latin into French, again and again; to make a good translation you need only common sense and very little knowledge of grammar or other pedantries."

It was in 1842, at the age of not quite nineteen, that Henri Fabre, qualified by his diploma to teach in elementary schools, obtained a position as pupil-teacher at Carpentras, twenty miles northeast of Avignon. The salary paid to teachers in the "college" of Carpentras did not exceed seven hundred francs (about one hundred and thirty dollars) a year. Of course the French word *collège* must not be taken in the sense attaching to our word of like spelling; and of course, also, seven hundred francs went much farther in 1842 than would the same amount in these days, or even than it would have gone before the present depreciation of French currency. But even for those times the pay was niggardly, and there was no pension system or other

alleviation to the lot of the worn-out or otherwise disabled teacher.

To Fabre, and indeed to any one, there was nothing inviting in either the outward aspect of Carpentras College or the pupils that pursued their studies there. The class-rooms, poorly lighted and ventilated, were nothing but forbidding holes reeking with dampness; and the pupils, as Fabre saw them, were dirty and coarse, ranging from children to overgrown boys, with whom he had many a tussle in the way of discipline, but whom he finally subdued and made to respect him; for he was a born instructor of youth, knowing how to win and hold his pupils' attention and, what is more, their interest in their studies.

A passage from Fabre's own pen will give an idea of the educational standards of those times in the elementary schools of France. In the higher institutions of learning all studies except Latin and Greek were held in slight esteem, he tells us, and then he continues:

"A brief character sketch will suffice to show how little importance was then attached, in the educational scheme, to the physical sciences, which now fill a large place in the training of the young. Our school had as principal an excellent man, the worthy Abbé X——, who, with little taste for the details of administration, had handed over to a kinsman the running of the boarding-house that formed a part of the institution, while he applied himself to the teaching of physics.

“Let us attend one of his classes. The subject of the day’s lesson is the barometer. By some lucky chance the establishment owns one. It is an antique contraption, all covered with dust and hung high on the wall out of reach of the profane. Inscribed in large letters on its woodwork are the words, ‘storm,’ ‘rain,’ ‘fair.’

“‘The barometer,’ begins the good abbé, addressing his pupils, whom he calls by their first names in fatherly fashion, ‘the barometer predicts the weather, telling us whether it is to be fair or foul. You see the words written on the frame, “storm,” “rain”—you see them, don’t you, Bastien?’

“‘Yes, sir, I see them,’ replies Bastien, the most mischievous boy in the class. He has already been through the text-book and understands the barometer better than does the professor himself.

“‘It consists,’ continues the abbé, ‘of a glass tube bent upward in a U shape and full of mercury, which rises or falls according to the weather. The shorter arm of this bent tube is open at the end; the other arm—well, that is what we are going to find out. You, Bastien, you are tall enough for it; step up on that chair and feel with your finger whether the longer arm is open or closed. I really don’t quite remember.’

“Bastien marches to the chair, mounts it, and makes himself as tall as possible on his tiptoes; then with one finger he feels of the top of the longer arm of the tube. This done, an innocent smile, under the downy growth of his incipient mustache, lights up his open countenance.

“ ‘Yes, sir, I can feel it,’ he reports; ‘the longer arm is open at the end. I can put my finger into it.’ And as if to corroborate this untruthful assertion, he continues to move his index-finger across the closed end of the tube, while his accomplices in mischief stifle their mirth as best they can.

“The abbé, quite unperturbed, continues: ‘That will do, Bastien. You may step down. Write in your note-books, boys, that the long arm of the barometer is open at the end. Otherwise you might forget it. I had forgotten it myself.’

“That was the way physical science was taught. But at last things took a turn for the better. A teacher, a real teacher was engaged, who knew that the long arm of a barometer is closed at the end. And as for myself, I obtained tables for my pupils to write on instead of scribbling on their knees. My class grew in size daily, and before long it had double the number it started with. Then, as soon as I had an assistant to handle the younger boys, things took on an entirely different look.”

The qualification “real” applied to the new physics teacher is one that the writer might truthfully have applied to himself; for with all his modesty he must have known himself to be a born teacher because his heart was in his work and he could command willing and respectful attention. Much of the secret of his success in teaching lay in his own eagerness to learn. He imparted no little of this eagerness to his pupils, and it not seldom happened that, unsuspected by them, he was learning as he taught, always keeping far enough ahead

of his class to show real mastery of the subject. More than once in his writings he declares that the best way to learn a thing is to teach it. Accordingly these beginning years of teaching in the life of Fabre are here grouped with the later years of his formal schooling in preparation for teaching. He was not yet out of his 'teens, and what he was still to learn, from books, from nature, and from general observation and experience, greatly exceeded the knowledge he had thus far acquired.

Fabre's position at Carpentras was, officially, that of director of the preparatory department of the college, though it is evident from his own account of his work there that he eagerly embraced any opportunity to give less elementary instruction. Let us follow his narrative of that youthful period of high hopes and vaulting ambitions, when, "only a few months out of the Normal School" and armed with "a diploma and the ingenuous enthusiasms of eighteen years," he went forth to make a name for himself in the educational world. It was an ungainly lot of boys, little and big, "all jumbled together," that he had to lick into shape, metaphorically speaking. They showed all degrees and varieties of ignorance, but were united in one respect, a fixed determination to play tricks on the master, the new teacher who was younger than some of his pupils.

"Among the subjects taught," writes Fabre, "one especially was in high favor with all concerned, teacher as well as pupils. It was open-air geometry, or practical surveying. The college had

none of the necessary apparatus, but with my handsome salary of seven hundred francs I could not hesitate to assume the expense of supplying this lack. Surveyors' chain and marking-stakes, pegs and spirit-level, square and compass—all these were procured at my cost. A small graphometer for measuring angles, an instrument hardly bigger than my hand and worth perhaps five francs, was furnished me by the institution. We lacked a tripod, but I had one made. And so there I was, all fitted out."

It is curious to note, by the way, how many an independent and enterprising young genius has been attracted by the charms of "practical geometry," as Fabre calls the science of land-surveying. There are Washington and Lincoln, to name no others, who early in life (Washington at the age of sixteen) became successful practitioners of the surveyor's profession. Shall we conclude that the peculiar charm of this calling for so many gifted young men lies in its happy mingling of theory and practice, of the abstract principles of mathematics and the very concrete question of determining the number of acres in Brown's pasture or the exact boundary line between Cedartown and Oakwood? Something, at any rate, that appeals to the practical idealist seems to be found in this useful and at the same time not undignified occupation.

"Once a week," Fabre continues, "beginning about the first of May, we left our gloomy classroom and took to the open fields. It was a regular picnic. The boys contested for the honor of carry-

ing the marking stakes, which were divided into bundles of three so that more than one shoulder, as we passed through the village, might be glorified in the sight of all by bearing the splendid insignia of geometric science. As for myself, why should I hide the fact that I could not help feeling a certain elation at being the bearer of the most delicate part of the outfit, the five-franc graphometer, which I handled with something akin to religious veneration?

“Our field of operation was a level stretch of waste land covered with stones, a veritable *harmas*, or wilderness, as it would be called by the natives. No screen of hedge or underbrush prevented my exercising strict surveillance over my young assistants; and, what was better still, I was troubled by no fears lest my pupils should succumb to the irresistible temptation of green apricots. The tract of land was long and wide, covered only with blossoming thyme and well-worn pebbles. It afforded us ample room for laying out all imaginable polygons, and triangle and trapezium could there enter into every possible kind of combination. We could sight distant objects with no intervening hindrances, and even a tumble-down shanty that had once been a dovecote was welcome as a structure on which to exercise our skill in vertical measurement.

“Now it happened that from the very start something aroused my suspicions. If a pupil was sent to a distance to plant a stake, I noticed that he kept stopping on the way, stooping down and searching and stooping again, heedless of the proper align-

ment and blind to all signals. Another, entrusted with the duty of gathering up the pegs, would overlook the thing he was sent out to get and would pick up a pebble in its place. A third, supposed to be measuring angles, would be seen crumbling a clod of earth in his fingers. And the greater number of the company were occasionally caught licking the end of a straw. Meanwhile polygons and diagonals suffered neglect. What did it all mean?

“I instituted some inquiries, and the mystery was explained. My pupils, regular little ferrets, all of them, had long known what was unknown to their teacher. On the stones scattered over the plain a large bee makes nests of clay. In these nests there is honey, and my pupils were in the habit of opening them so as to suck up the treasured sweet through a straw. They very kindly showed me how to do it. The honey, though rather strong in flavor, is not at all bad. I acquired a liking for it myself and joined in the search for nests. The polygons could wait. So it was that I made my first acquaintance with the mason-bee of Réaumur, ignorant then of its history and equally ignorant of its historian.”

Readers of Fabre will appreciate the significance of this discovery to him. What he has made known to the world about the mason-bee forms one of the most notable, most interesting, we can even say most fascinating chapters in all natural history.

CHAPTER V

A STEEP AND THORNY WAY

IT was no primrose path of dalliance that Fabre was to tread henceforth, but rather the steep and thorny way leading to what must often have seemed to him a very distant heaven.

At no time had it been his plan to remain always a mere schoolmaster. He had visions of higher things, of a professorship in a university, of research work, of contributions to the sum of human knowledge. But in order to obtain a higher position in his present profession it was first necessary to pass certain examinations. In mathematics and the sciences he saw the most promising opening for him at this time, and so he diligently applied himself to the study of these branches, devoting his evenings and holidays and even the late hours of the night to this preparatory work. He would toil on into the small hours until he could no longer keep his eyes open, and then only would he, reluctantly, seek his couch. It was drudgery, but it was intellectual drudgery, it was acquiring knowledge, and the eager learner rejoiced in the vigor, the receptiveness, the retentiveness of his mind. He had a good head on his shoulders and felt a pardonable satisfaction in proving it, to himself if not to others. In a letter of fatherly counsel, at about this

period, to his brother, then teaching at Lapalud near Orange, we get a glimpse of his method and catch something of his enthusiasm for strenuous intellectual exercise:

“It is Thursday, and your time is your own. You find a quiet corner where there is a soft light, and you sit down at your table with a book open before you, your elbows planted one on each side of the book, and a thumb behind each ear. Your wits are wide awake and your will is in complete command of your faculties. The outer world ceases to exist for you, the ear is deaf to all sounds, the eye blind to all exterior things. Your whole soul is absorbed in study, in recalling past fragments of knowledge and in pushing its explorations further into the domain of science. Light dawns upon the understanding. The hours that follow speed on winged feet, with no consciousness on your part of their lapse. It is evening already. But what a flood of new truth has been pouring into your mind, while the difficulties that baffled you yesterday have melted away in the ardor of your assault upon them. You have devoured volumes and are well content with your day’s work.

“When you come to a hard place, don’t run to your comrades for help, for that would be only getting around the difficulty instead of overcoming it with patience and thought. Besides, we really know only what we have learned for ourselves; and so I advise you to seek in your study of the sciences no aid but reflection. A text-book of science is an enigma to be solved. If some one gives you the

key to the enigma, nothing could be easier or more natural than the solution; but when the next puzzle presents itself, you will be no better fitted for disentangling it than you were for unriddling the first.

“You will probably have opportunities for giving private lessons; but don’t choose the easiest and the best-paying courses; choose rather the hardest, even though they may be in subjects not yet mastered by you. Self-respect, which would be overcome with shame at any display of ignorance on your part, is a powerful aid to the will to learn. Follow the example of Jules Janin¹ when he was running from house to house in Paris giving Latin lessons for a miserable pittance. ‘Unable to get anything out of my stupid pupils,’ he writes, ‘I would sit down beside the wooden-headed son of a marquis and make myself at once student and professor. I elucidated to myself the ancient authors and thus, in a few months, gave myself an excellent course in rhetoric.’

“Above all, don’t get discouraged. Time is nothing, provided the will be always tense, always active, never dismayed. Strength will increase as you go on. Just try for a few days the method of work by which all your energies, concentrated at one point, produce an explosion as of a mine, and send the obstacles flying. Try for a few days what patience can do, see what power there is in perseverance, and you will discover that no difficulty is insuperable.”

¹ Jules Gabriel Janin (1804—74), French novelist, dramatic critic, and literary historian.

Teaching himself physics and chemistry in view of approaching examinations, Fabre had to devise his own laboratory equipment out of homely kitchen utensils and other odds and ends. The simple experiments that he makes so fascinating to readers in his "Wonder Book of Chemistry" were performed by him before a class of learners only a little less versed than he in the mysteries of this science. He was never content to learn a thing by himself and not impart his dawning knowledge to others; in fact, as already remarked, he held that imparting knowledge is the best way to acquire it.

It was while he was still a pupil at the Primary Normal School of Avignon that his attention was first called to the science of chemistry. At a free lecture on oxygen he watched, from a discreet distance, the preparations for the production of this gas. "I have an aversion," he confesses, "for the mob of the curious who elbow their way to the front and quarrel for the best positions when there is anything to see, even if it be only a dog-fight." This aversion did him a good turn on that occasion, for the oxygen experiment went wrong and there was a violent explosion, with scattering of sulphuric acid and splinters of broken glass, and consequent injuries to the "mob of the curious" in the forward rows. One of his fellow-pupils received a generous splash of acid full in the face, even in the eyes. "He shrieked like one of the damned," says Fabre, who with much presence of mind dragged him to the water-faucet outside and held his face under

the stream, until the patient was sufficiently composed to continue, unaided, the application of the simple remedy. Eyesight was saved, thanks to the promptness and good sense of the only cool-headed member of the crowd, and in a week, with the help of certain medicinal lotions, all danger was past.

This experience Fabre turned to good account when, in order to learn chemistry, he undertook to teach it, in a series of simple experiments, to his motley band of pupils at Carpentras. A course in this science was a thing without precedent there, and prejudices and other obstacles had to be overcome at the outset; but the purposeful young teacher was convinced of the practical usefulness of a little chemistry to the prospective farmers and manufacturers under his charge, and so he at last persuaded the head of the school to let him carry out his novel scheme. Poverty of equipment and smallness of means for procuring the essentials had to be contended against; but where there's a will there's a way, and the experiments came off with brilliant success, much to the satisfaction of all concerned. Fabre's own account of his hopes and fears and anxieties in breaking a path into this unknown domain is too good, too characteristic, to be wholly omitted here.

"In my spare moments," he says, "with the help of a text-book, I made my plans. I said to myself, I will do so and so, I will proceed thus and thus, but above all I must run no risk, take no chances that might lead to loss of eyesight, for I shall have to treat bioxid of manganese with sulphuric acid

under certain conditions of temperature. Fear assails me at the remembrance of my schoolmate shrieking like one of the damned. Bah! I will risk it, all the same. Fortune favors the brave. Besides, as a precaution never to be neglected, I will allow no one but myself to approach the table. Then if any accident occurs I shall be the only one hurt, and to my thinking it is well worth while getting a little burn on one's skin for the sake of making the acquaintance of oxygen.

"Two o'clock strikes; my pupils enter the classroom. I purposely exaggerate the danger in my opening remarks. All are to take their seats and no one is to budge. My orders are obeyed. I am left with plenty of elbow room. No one is near me except my assistant, erect at my side and ready to lend a hand at the right moment. In profound respect before the unknown, all are attentive and there is perfect silence.

"Pretty soon a bubbling sound makes itself heard, *gloo, gloo, gloo*, as the tiny globules of gas ascend through the water that fills the bell-glass. Can it actually be the gas I am after? My heart beats fast with excitement. Is it possible that I have succeeded at the very first attempt, and succeeded without a single disturbing occurrence? We'll see. A candle is lighted and then immediately extinguished, but in such a manner as to leave a red glow in the wick. Next it is lowered, by means of an iron wire, into a glass jar that I have filled with the gas just produced. Capital! The candle bursts into flame with a little explosion and

continues to burn with extraordinary brilliance. The gas is indeed oxygen.

“It is a solemn moment. My audience sits there lost in astonishment. I am even more so, but rather at my success than at the relighting of the candle. I am puffed up with vainglory, I feel the warmth of enthusiasm coursing through my veins, but no sign of these peculiar sensations do I allow myself to betray. In his pupils’ eyes a teacher ought to be thoroughly accustomed to the things he teaches. What would my sharp little rogues have thought of me if they had known that this was the very first time I had witnessed the marvels that held them spellbound? I should have lost their confidence; I should have sunk to the level of a mere learner.

“Courage, then! Let us go on as if chemistry were the tritest of commonplaces to me. Now comes the experiment with a steel ribbon, an old watchspring twisted into corkscrew shape and carrying a bit of tinder at one end. This simple priming being ignited, the steel ought to take fire in a jar filled with my newly made gas. It does take fire, in very truth, and it makes a very pretty piece of fireworks, crackling, spitting bright sparks, and sending up a sort of rust-colored smoke that powders the inside of the glass jar. From the lower end of the fiery spiral there detaches itself, every few moments, a glowing drop, which passes with a hissing sound through the layer of water left in the bottom of the jar and embeds itself in the glass by suddenly melting it.

“This metallic shower, so fierce in its heat, fairly startles us. Exclamations and applause burst forth. The timid ones shield their faces with their hands and venture only to take a peep through their fingers. My audience is exultant, I am triumphant. So, my young friends, is n’t chemistry fine?

“To every one of us there come, in the course of a lifetime, days of good fortune, days worthy of being marked with a little white stone. Some of us, the positive and energetic ones, have gone out into the business world and have earned money; and such persons hold their heads up proudly. Others, the meditative ones, have won ideas, have opened for themselves a new account in the great book of facts; and they rejoice in silence with the holy joy of truth achieved. One of my memorable days was that on which I first made the acquaintance of oxygen. On that day, my chemistry lecture ended and all the apparatus put away, I felt my stature increased by a span. Inexperienced operator though I was, I had just shown to my pupils, with complete success, what a couple of hours before had been quite unknown to me. Not the slightest accident had happened, not the smallest drop of acid had been spilled. It was n’t, then, so difficult or so dangerous as I might have thought from the disastrous ending of that experiment witnessed by me in my student days. With watchfulness and prudence it would be possible for me to continue. The prospect filled me with rapture.

“In its turn I take up hydrogen, having first carefully read up on the subject and seen again and

again in my mind's eye what I was later to see with my bodily vision. I delight my young rascals by causing a hydrogen flame to sing in a glass tube, down the inside of which trickles in tiny drops the water resulting from the combustion; and I make the whole class start when I explode my mixture of oxygen and hydrogen.

"Later there follow, always with the same success, experiments showing the splendor of phosphorus, the violence of chlorine, the disagreeable smell of sulphur, the metamorphoses of carbon, and other curious things. In short, one lesson following another, there are passed in review, before the year ends, the principal non-metallic elements and their compounds.

"The thing was noised abroad, and new pupils came, attracted by these wonderful performances. In the boarding-house it became necessary to lay a few more plates at table, and the principal, more occupied with peas and bacon than with the chemical elements, congratulated me on this increase in the number of boarders. I was fairly launched on my career. Time and an indomitable will were bound to do the rest."

A companion piece to the foregoing is Fabre's account of how he taught himself mathematics by teaching a comrade. Certain requirements were to be met in order that he might qualify himself for a higher position, and his comrade's case was much like his own.

"Would you like to have me tell you," he asks his readers, in a delightful vein of intimacy and candor,

“how I fed myself on enough algebra to be able to find my way through the logarithmic tangle, and how I became surveyor of spiders’ webs? Would you like to have me do this? It will give us a moment’s respite from the study of natural history.

“I seem to see a nod of assent. My earlier account of the village school I attended as a boy, with its daily visits from chickens and pigs, has been received with some favor; then why should not my subsequent rather arduous self-schooling also be of interest? Let us see if I can’t tell the story; and—who knows?—it may perhaps help to brace the courage of some other unfortunate, some other eager seeker after knowledge.

“A regular education under a teacher’s direction has been denied me; but I should be in the wrong if I complained of this, for solitary study has its peculiar value: it does not cast you in any official mold, but leaves you your originality unimpaired. Wild fruit, if it comes to maturity, has a different flavor from that of the cultivated variety. It leaves on the palate of him who can appreciate it a mingled bitterness and sweetness whose merit lies in the very contrast of these qualities.

“If I had it to do over again I still would choose to place myself face to face with the text-book as my sole counselor, though not always a perfectly intelligible counselor. I would consent to repeat my nights of solitary study, my wrestlings with the obscure, whence, after many determined attacks, emerged at last a gleam of light. I would travel over again those toilsome stages of long ago, in-

spired with the single desire, which has never yet met with failure, to learn and afterward to teach others what little I had learned.

“On leaving the normal school my mathematical baggage was of the most modest description. The extraction of a square root and the calculation of the surface of a sphere, with accompanying demonstration, were for me the crowning achievements of mathematical science. The terrible tables of logarithms, when by chance I stumbled upon them, made me dizzy with their piling up of numbers. A sort of fright, mingled with respect, used to seize me at the very threshold of that cave of calculations. Of algebra I had not the slightest notion. I merely knew the name, which to my poor understanding stood for a bewildering maze of tangled abstruseness.

“I had no desire to explore these mysteries. In my opinion they constituted one of those indigestible dishes that we commend to others but never taste. How much rather did I prefer a fine line from Virgil, whom I was just beginning to understand! Great would have been my surprise had any one told me that I was going to devote myself passionately, for years without interruption, to such studies as those, my aversion and horror at that time. It was to a stroke of good fortune that I owed my first lesson in algebra, a lesson given, it will be understood, and not received.

“A young man of about my own age came to me with a request that I should teach him algebra. He was fitting himself for the government department

of highways and bridges, and was preparing for his examination. So he came to me, mistaking me, in his innocence, for a well of learning. Ah, how far out he was in his reckoning, that ingenuous young man!

“His request gave me a start of surprise, but sober reflection caused me to repress it at once. ‘Teach algebra?’ said I to myself. ‘What an insane idea! I don’t know the first word of algebra.’ And there I let the matter rest for a few minutes while, lost in thought, I was torn by conflicting impulses. ‘Ought I to accept or ought I to refuse?’ continued the inner voice.

“Bah! Why not accept? A heroic method of learning to swim is to jump boldly into the water. So why should n’t I jump head first into this yawning gulf of algebra? Perhaps the imminent danger of drowning would so arouse my efforts as to get me out of it, safe and sound, after all. I knew nothing of the subject, but never mind. Forward with a bold front! I would learn by teaching.

“Ah, the splendid audacity that plunged me with hardly a moment’s reflection into a region I had never before dreamed of entering! What an incomparable spring of action is the assurance of twenty years!

“‘All right,’ I replied; ‘come the day after tomorrow at five o’clock, and we will begin.’

“Under this respite of twenty-four hours was concealed a plan of mine. I should have one day’s reprieve, the blessed Thursday,¹ which would give

¹ The weekly school holiday.

me leisure to muster my forces a little. Thursday came. The sky was gray and cold. In disagreeable weather like that a grate heaped with coke is a delectable thing. I would get warm and meditate.

“‘Well, old fellow,’ said I to myself, ‘a fine scrape you’ve got yourself into! What are you going to do to-morrow? With a text-book and a night’s hard work you might perhaps prepare some sort of a lesson, just enough to enable you to squeak through the dreaded hour; and then you’d have a breathing-spell before the next ordeal. Sufficient unto the day . . .

“‘But you have no book. A visit to the bookseller would be of no use. Text-books of algebra are not current merchandise. You would have to order one, and then you wouldn’t get it for a fortnight at least. And the lesson comes to-morrow, to-morrow without fail; you have given your word. Furthermore—and this is a knockout for you—your funds are low; your last coppers are there in a corner of that drawer, and you have counted them: they amount to just twelve sous, a sum entirely too small.’

“‘Was I then to give up? Never! A last resort occurred to me. It was a rather ticklish way out, truly enough, and came perilously near to being petty larceny. O ye lofty sublimities of algebraic science, in your name was this venial sin committed! I here make confession of my momentary straying from the path of virtue.

“‘The mode of life at my college partook somewhat of the cloister. For a modest sum we were,

most of us instructors, lodged in the institution, and we ate at the principal's table. The professor of science, a great personage on the staff, lodged in the town, but had, like the rest of us, his two little rooms in the college building, and in addition a terrace where the noxious gases produced in his chemical experiments were discharged into the open air. Consequently he found it more convenient, most of the year, to give his lessons at his rooms. There, in winter, before a grate piled full of coke, as I used to pile mine, his pupils would assemble; and there they would find an ample equipment in the way of blackboard, air-pump, glass balloons on the mantelpiece, an array of bent glass tubes hung on the wall, and, finally, a certain cupboard in which on several occasions I had caught a glimpse of rows of books, oracles consulted by the professor in the course of his lessons.

“Among those books, I said to myself, I think I saw a volume on the subject of algebra. The idea of asking to borrow it from the owner did not commend itself to me. My dear colleague would have treated me with all the dignity of his exalted station and would have heaped derision on my ambitious projects. I should have been bowed out with a polite refusal, I am certain. The future was to prove how correctly I had taken his measure. Narrow-mindedness and petty jealousy are to be found everywhere.

“But that book, which I was sure would be refused me if I asked for it—why not go and get it? There were no recitations that day, the pro-

fessor would not put in an appearance, and the key to my room was almost a duplicate of the key to his.

"I tiptoed into the passageway, my ears and eyes on the alert. Cautiously I inserted my key into my colleague's keyhole. It stuck, then with a little pressure turned in the lock, and the bolt was shot back. The door opened, I advanced to the cupboard, and there, surely enough, was the algebra—a fat little volume such as used to be published in those days, being fully three fingers thick. My knees were shaking under me. Ah, you house-breaker, you thief, what if you had been caught in this nefarious business? But all went well, I hastily reclosed the doors I had opened, and returned to my room with my booty.

" 'Now for us two, all by ourselves,' said I, 'you darkly mysterious old tome with an Arabic name suggestive of occult sciences and associated with such weird terms as *almagest* and *alchemy*. What are you going to show me? Well, let us turn the pages in a rapid, haphazard way, so as to get some sort of a preliminary survey of the whole. Before pausing upon any fixed point in the landscape it is well to get a general view of its entire extent.' Page after page passed in rapid succession under my eyes, telling me little or nothing; but in the very middle of the volume I found a chapter that arrested my attention. It was entitled 'Newton's Binomial Theorem.' "

Those who have carried their study of algebra as far as the binomial theorem, the terror of many

a young mathematician, will appreciate this self-taught student's intellectual fiber as manifested in his bold attack, at the very outset of his algebraic studies, on so formidable a difficulty. Even the un-mathematical reader will get some hint, from Fabre's narrative, of the indomitable pluck, the sheer grit, with which he was wont to hurl himself upon any obstacle that presented itself in his chosen path. Let us continue with his own account of his method of assault.

"My curiosity was excited," he tells us. "What in the world was a binomial theorem, and above all one named after the great English scientist who weighed the planets? What had it to do with celestial mechanics? Let us see what the book says, I said to myself; let us try to get some light on the subject. And so, elbows on table and thumbs behind ears, I concentrated my whole attention on the problem.

"Surprise took possession of me: I actually began to understand. The thing had to do with a certain number of letters—general signs which were assembled in groups of all sorts, were placed now here, now there, and again somewhere else, turn and turn about. There were, according to the book, certain arrangements, combinations, permutations. Pen in hand, I arranged, combined, permuted. Truly, it was a highly diverting exercise, a sort of game in which the result finally arrived at tallied with one's logical expectations and reinforced one's abstract reflections on the subject.

"It will be a gift from heaven, thought I, if alge-

bra is n't any harder than this. My dazzling illusions were destined to be somewhat dimmed when to the binomial theorem, a delicious bit of cake, succeeded the hard and less digestible sea-biscuit. But for the time being there was no premonition of future difficulties, no frightful bog into which one sinks deeper and deeper the more one struggles to extricate oneself.

"Ah, that delightful afternoon before my grate, all my wits engaged in those combinations and permutations! When night came I pretty nearly had my subject in hand. At seven o'clock, when the bell called us to the principal's table for our evening meal, I went down in a state of elation, my heart filled with the joy of the neophyte at being admitted to the honors of initiation. Interlacing garlands of learned-looking *a*'s and *b*'s and *c*'s were festooned along the way.

"Next day my pupil presented himself. Blackboard and chalk were all in readiness; but somewhat less so was the teacher. However, I struck boldly into my binomial theorem, and my hearer became interested in the combinations of letters. Not for a moment did he suspect that I had, in scandalous disregard of convention, put the cart before the horse and begun where we ought to have finished. I relieved the tedium of my explanations by interspersing a few simple problems, thus allowing a breathing-spell before another plunge ahead. Together we tackled the difficulties that confronted us. In a discreet manner, so as to make my pupil think the solution his own, and therefore assume the

credit for it, I advanced for his consideration such suggestions as seemed likely to prove fruitful. Thus the algebraic snarls were one after another disentangled, and my pupil enjoyed the triumph, while I also exulted, but secretly and in my inner consciousness, which whispered to me: 'You understand because you make some one else understand.' For us both the hour passed quickly and very agreeably. My young man went away highly content, and I was not less so, for I was finding out a new and original method of acquiring knowledge.

"In the midst of this fascinating study of the binomial theorem I found time to attack my text-book of algebra at the beginning, and in three or four days I had my weapons all furbished up and in readiness for battle. Addition and subtraction contained nothing that could detain us; so simple are they that they are understood at a glance. But when it came to multiplication things did not go so smoothly. There is a certain rule as to plus and minus signs, to the effect that minus multiplied by minus gives plus. What a source of vexation that seeming paradox was to me at first! The text-book somehow failed to make the thing clear; it employed a method that was too abstract. In vain I read and re-read and pondered; still the mystery kept its secret to itself. That is the fault of books in general: they tell you what is on the printed page, but nothing more. If you don't quite understand, there is no enlightening word from the book, no attempt on its part to lead you along another path that shall finally bring you out into the open.

Often a mere word would suffice to put you in the right way, but that word is not forthcoming from a page printed from a stereotyped plate.

“How infinitely preferable is the oral utterance in such cases! First it goes ahead, then returns once more to the starting-point, makes a new beginning, skirts the obstacle, and attacks it from another side, so that in the end darkness turns to light and all is clear. This incomparable illumination afforded by the timely word of mouth was denied me, and I was in danger of shipwreck, with no hope of rescue, in that treacherous sea of plus and minus signs.

“My pupil must have perceived my embarrassment. After attempting an explanation into which I tried to throw the feeble glimmer of light that I imagined myself to see, I asked him:

“‘Does that make it clear?’

“A futile question, in truth; but it helped me to gain a little time. Not seeing the thing clearly myself, I of course knew well enough that he could not see it any better.

“‘No,’ he replied, perhaps blaming himself, honest fellow, for dullness in failing to grasp these transcendental verities.

“‘Well, then,’ said I, ‘let us go at it differently.’

“And I put the matter first this way and then that, and then still another, while my pupil’s expression served me as a thermometer, telling me whether I was getting ‘warm’ or the reverse. Finally, a little flash of intelligence announced my success. I had hit the nail on the head. The product

of minus times minus was no longer a mystery to us.

“In this fashion our studies went on, my pupil remaining a passive receiver, taking in ideas that cost him no great effort, and I digging and mining and dynamiting until the solid rock of the text-book yielded to my assaults and gave up its embedded gems of truth. The operation cost me in the end a good deal of midnight oil. Another task, not less arduous, also fell to me; I mean the task of simplifying and making more intelligible the abstruse statements of the book, so that they could be presented to my pupil in a less forbidding form. This task, which may be likened to the lapidary’s cutting of a precious stone in order to let more light into it, was a favorite occupation of mine in leisure moments, and I am indebted to it for much intellectual profit.

“Well, the upshot of it all was that my pupil took his examination and passed it successfully. As to the text-book that I borrowed so clandestinely, it has long since been returned and another has taken its place—one that I can this time call my own.”

CHAPTER VI

ONWARD AND UPWARD

AFTER thus grounding himself in algebra, our young aspirant for better and higher things in his chosen calling felt moved to perfect himself likewise in geometry.

“At my normal school,” he says, “I had learned a little elementary geometry under a teacher’s direction. From the very first lesson I conceived a liking for the subject. I suspected that here was a method for guiding the understanding through the wilderness of ideas. I seemed to discover a path by which one could seek truth without stumbling over-much on the way, because each step forward has the firm support of the immediately preceding step. I divined in geometry what, before all else, it certainly is—a school of intellectual fencing.

“Little did I care for the practical application of the particular truths demonstrated; what I did most heartily enjoy was the going after the truth. One sets out from a point that is perfectly clear, and by degrees one pushes one’s way into the darkness, which in its turn becomes light as one advances, and at the same time this new light opens the way for further progress. This methodical advance from the known to the unknown, this trusty lantern illuminating what follows with the radiant

beams of what precedes—that was the thing that appealed to me.

“Geometry, as I conceived it, was to teach me to be logical in my way of thinking. It was to tell me how the difficult is divided into sections which, made clear one after another, are finally combined in a sort of lever capable of lifting and overthrowing the granite boulder that would not have yielded to any direct attack. It was, in short, going to show me how order is brought out of disorder, light out of darkness.

“If it has ever been given to me to write a few pages that the reader could follow without too much fatigue, I owe it largely to geometry, that wonderful educator in the art of thinking. To be sure, it does not furnish ideas, those delicate flowers that unfold one knows not how; but it brings order out of confusion, disentangles what is snarled, calms what is agitated, filters the turbid, and gives us clearness, which is far superior to anything that mere rhetoric can achieve.

“Yes, as a workman who plies the pen I owe much to geometry. Consequently my reminiscences gladly go back to those happy hours of my apprenticeship when, retiring into a corner of the garden for the recreation period, with a sheet of paper on my knee and a bit of pencil between my fingers, I busied myself deducing such and such a property from such and such a combination of straight lines. My schoolmates were at their games all about me, while I found sport of the kind I liked in a truncated pyramid. Perhaps it would have been better

for me in the end if I had spent the time in developing my leg muscles by jumping or in limbering up my loins by turning somersaults. I have known some who, having achieved skill in turning somersaults, have prospered better than the thinkers.

“When I began to teach I already had some smatterings of geometry. At a pinch I could handle the surveyor’s chain and stakes, and that was about as far as my ambitions went in that direction. To be able to reckon the cubical contents of a log of wood or the capacity of a hogshead, and to estimate the distance of some inaccessible point—these achievements seemed to me the highest flights of geometric science. Was there anything higher? If there was I had no suspicion of it until a chance gleam of light showed me how pitifully small was the little patch of ground I had been cultivating in the vast domain of things to be known.

“At that time the college where for two years I had been teaching had recently doubled in size—that is, in the number of its students—and had considerably increased its teaching force. The new teachers had rooms, as did I myself, in the college building, and we all ate together at the principal’s table. We formed a sort of beehive in which, during leisure hours, was elaborated the honey of algebra and geometry, of history and physics, and above all of Greek and Latin—sometimes with a view to the next lesson to be given in the classroom, but oftener in preparation for approaching examinations leading to higher academic degrees. Our college diplomas lacked variety. All my col-

leagues were bachelors of letters, and nothing further; but one must be rather better equipped than that if one wishes to cut any sort of figure in the world. And so we toiled early and late. I was the youngest of the whole community of diligent workers, and not less eager than the rest to augment my humble educational baggage.

“Frequent visits from room to room were the order of the day. One would drop in on a neighbor to get help on a difficult point and to chat a few minutes on the state of the weather. The room next to mine was occupied by an ex-quartermaster who, weary of barrack life, had turned to teaching for a change. It had fallen to him in his official capacity to supervise the written exercises of the men in his company, and thus he had acquired some little familiarity with figures. Thence had sprung the ambition to win the diploma of bachelor of mathematical sciences. But his mode of life in the regiment seemed to have hardened his brain tissues. According to what I was told by my dear colleagues, peddlers of not always the best-natured gossip concerning the trials and tribulations of others, he had already twice gone up for examination, and twice been turned down. Undismayed by repeated failure, he had returned to his books and set himself pluckily to work, in the resolve to try his luck once more.

“It was not that he was seduced by the charms of higher mathematics; far from it; but the diploma he was after would help him to realize certain cherished ambitions. He aspired to high office in the

commissary department, and to the emoluments that went therewith. The ardent student poring over his books for the sole satisfaction of acquiring knowledge, and the coolly determined chaser after diplomas for their pecuniary value in the struggle for a livelihood, were not made to understand each other, and were not likely to seek each other's society. It was chance that brought the two together.

"Many a time I had, of an evening, come upon this neighbor of mine and found him, elbows on the table and head in his hands, studying by the light of a candle a large note-book in front of him, all scribbled over with cabalistic symbols. From time to time, an idea having come to him, he would seize a pen and hastily write a line in which the letters, whether large or small, grouped themselves without any apparent rhyme or reason. There was frequent recurrence of x and y , intermingled with figures. At the end of the line would be placed the sign of equality and then a zero. This mysterious proceeding concluded, there would come another period of meditation with eyes closed, followed by the writing of a new line of letters arranged in a different order, but ending again with zero. Page after page was filled in this strange manner, and every line closed with the inevitable zero sign.

" 'What are you doing,' I asked one day, 'with all those lines that have, each and every one of them, a value of zero?'

"The mathematician looked at me in a crafty way he had acquired in the barracks. A gleam of superior cunning showed in his eyes and indicated

to me how he pitied my ignorance. Nevertheless my zero-loving colleague refrained from taking any unfair advantage of my intellectual inferiority; he condescendingly informed me that he was studying analytical geometry.

“His answer had a strange effect on me. There was, then, I reflected, a higher geometry that has to do especially with combinations of letters in which x and y play the chief part; and when this neighbor of mine ponders so long with his head in his hands he is trying to find the meaning hidden under all those scrawls of his. There dances before him in empty space the significance of his algebraic calculations, translated into geometric diagrams. What did he see, I wondered, and how was it that alphabetical symbols arranged now in one way and now in another could represent a geometrical figure, an image visible only to the mind's eye? I was perplexed.

“‘I should like to learn analytical geometry some day,’ said I. ‘Will you help me?’

“He consented with a smile in which could be read his smallness of confidence in my perseverance. However, an agreement was entered into between us that evening by which we undertook to go over together both algebra and analytical geometry, the prime requisites for the baccalaureate degree in mathematics. We were to pool our resources, he his experience acquired in those evenings of solitary study, and I my youthful ardor; and we were to begin as soon as I had won my baccalaureate in letters, which was then my chief concern.

“In those early days it was the rule to let certain serious literary studies precede the courses in science. One was expected to cultivate the acquaintance of sundry celebrities belonging to ancient times, to hold converse with Virgil and Horace, Theocritus and Plato, before laying hands on the retorts and the test-tubes of the chemical laboratory or manipulating the levers and the pulleys with which the laws of mechanics are illustrated. This order of studies could not but work to the advantage of clear thinking and logical reasoning. But the stern necessities of modern life, necessities that are becoming more and more urgent in proportion as our progress in civilization afflicts us with new needs, have changed all that. A fig for your refinements of correct speech! Practical affairs in a practical world—what else is there of any importance?”

Those who have enjoyed and admired Fabre's clean-cut and aptly picturesque style, with its gleams of humor, its flashes of wit, and its occasional touches of irony, will be interested in the following account, from his own pen, of the studies by which he acquired his remarkable command of the *mot juste*, the one supremely appropriate word, and his ability to give that verbal gem its proper setting. Even the young reader may like to know how it has come about that “The Story Book of Science” and “The Wonder Book of Chemistry” and all the other delightful volumes in the elementary science series are written in a style that makes them so easy and

enjoyable to read and so little difficult to understand.

“This latter-day haste,” he tells us, “would have just suited my youthful impatience. I must confess that I cursed the regulations that imposed Latin and Greek upon me before allowing me to explore the domain of geometry and trigonometry. To-day, better advised and ripened by age and experience, I am of another mind. I deeply regret that my humble literary studies were not more wisely conducted and longer continued.

“In order to fill in a little, though late in the day, some of those yawning gaps left in my education, I have, with great respect, returned to those good old books that one usually sells, half-read, to the dealer in second-hand literary wares. Venerable volumes, annotated in pencil by me when as a youth I was wont to prolong my studies far into the night, have been hunted up, and now more than ever they have become my friends.

“They have taught me that the one all-important requirement imposed on him who handles a pen is to have something to say that will interest the reader. If the subject has to do with any of the natural sciences, it is more than likely to prove interesting; but the difficult part, the very difficult part, is to clear it of its thorns and present it in an attractive light.

“Truth, it is said, comes naked from the bottom of a well. Agreed. Nevertheless we must admit that it gains by being decently clothed. It demands,

not the frills and furbelows of rhetoric, but at least a fig-leaf. Mathematicians, and they only, have a right to refuse it even this modest costume. In demonstrating a proposition of geometry, clearness is enough on the mathematician's part. But all others, and naturalists especially, ought to drape a tunic of gauze around the loins of truth, and to do it with some little regard to elegance of appearance.

“If I say, ‘John, give me my slippers,’ I express myself in language that has the merit of clearness, but not much richness or variety. I know very well what I am saying, and my words are understood. There are some, and their number is large, who maintain that this simple manner of speech is the best for all uses. They talk science with their readers as they talk slippers with John. A syntax as crude as that of the Kaffirs does not repel them. Don't talk to them about the value of a carefully chosen word aptly placed, and still less about a rhythmical arrangement that falls pleasantly on the ear. That is all flapdoodle to them—finical niceties worthy only of a small mind.

“Perhaps they are right; John's way of speaking is a great economy when one is harassed with all sorts of duties and perplexities. But this advantage does not appeal to me, for I hold that in order to make an idea stand out clearly we should clothe it in perfectly lucid language reinforced with such simple and appropriate imagery as we can command. To find the fitting word, to put it in its proper place, and to make it say unmistakably what it is desired that it should say—all this requires a

careful and often a rather difficult selection on the part of the writer or speaker. There are dull, drab words, the ordinary rubble-stone of the conversational edifice; and there are also words that have color, so to speak, and that may be likened to the artist's brush strokes when he puts in splashes of light against the gray background of his painting. These picturesque words, these uncommonplace terms that arrest the attention—how are they to be found, assembled in a manner that shall do no violence to the rules of syntax and not offend the ear?

“This art was never taught to me. Is it an art that one can learn at school? I doubt it. If the passion for it does not run in our veins, if the inspiration is lacking in our soul, to no purpose do we thumb the dictionary; the right word will not come. To what masters, then, shall we go if we wish to foster and develop the tiny germ that may be lying latent within? To books.

“In my early youth I was ever an ardent reader, though the niceties of well-chosen language were of small interest to me; I did not appreciate them. Consequently it was rather late, at about the age of fifteen in fact, when I began dimly to perceive that words have a physiognomy of their own. Some pleased me more than others by the outstanding clearness of their meaning and the rhythmical quality of their syllables. They presented to my mind's eye a distinct image; in their peculiar manner they produced a painting of the object described. Colored by its adjective and animated by its verb, the noun became a living reality; what it had to say

stood before one in visible presence. Thus, little by little, whenever in my unguided literary course I chanced upon a page or two written with the skill that makes easy reading, there was revealed to me the magic that lies in words."

After this little excursion into the field of rhetoric the autobiography returns to the subject of mathematics and describes the author's astonishment at finding himself, not the pupil, but the teacher of his mathematical instructor:

"The hour arrived for taking up the study of analytical geometry. My mathematical colleague's coming was welcome, for it seemed to me I was by that time in a position to understand what he had to say. I had already looked through the textbook and perceived that the subject was handled in an entertaining manner and did not bristle with serious difficulties.

"We made a beginning in my room, with a blackboard before us. After a few lessons, which were prolonged far into the night, I discovered, to my great surprise, that my instructor, a veteran in the study of geometry, was in reality my pupil, oftener than not. He was rather muddle-headed on the subject of ordinates and abscissas, so that finally I made bold to handle the chalk and to take the helm of our mathematical bark. I offered my comments on the text and translated it in my own fashion; I searched for its true meaning and sounded its dangerous shoals and reefs, until at last we began to get a little light and were enabled to make in safety the port of triumphant solution. The whole thing

was, after all, so logical, so smoothly running, so lucid, that often one might almost believe oneself to be remembering rather than learning.

“In this manner we proceeded, our respective functions reversed, I plying the pick and breaking up the soil until it was light enough to be penetrated by our instruments of search, while my comrade—for so I may now call him—listened, offered his objections, and spurred me on by pointing out difficulties, which we strove with united efforts to overcome. With our combined levers inserted in the fissures of the rock that opposed our passage, we would make the obstruction yield a little and finally go toppling over out of our way.

“I now no longer saw on the ex-quartermaster’s face the patronizing smile with which he had received my first overtures. He was indeed by this time all frank cordiality and full of the hearty responsiveness that gave promise of our ultimate success. Gradually dawn was breaking on our horizon, a dawn that was rather overclouded, it is true, but not without signs of clearing. We were filled with wonder and delight, both of us, and my share in our common satisfaction was twofold; for he sees with redoubled clearness who makes others see. In such wise did we pass half the night together, and they were hours of pure enjoyment; and we parted only when we could no longer keep our eyes open, for very sleepiness.

“On returning to his room did my comrade sleep untroubled by the phantoms we had just evoked? Whenever I put this question to him he replied that

he had slept well, which was more than I could say for myself. To pass the sponge over my poor brain as I would over a blackboard, to efface what is written there, is something that I cannot do. The network of ideas remains like a spider's web, in which sleep gets stuck fast and I am powerless to release it. And when at last sleep does come, it is nothing more than a slight dozing off that by no means lessens the activity of the brain; rather does it quicken that activity and stimulate it more than would lying awake. In this torpor, which is not in any sense sleep to the brain, it used to happen that I would solve mathematical problems with which I had wrestled unsuccessfully in the daytime. On these occasions my mind would be in a state of extraordinary clearness. I would leap from my bed, relight my lamp, and make haste to write down the heaven-sent solution before it should escape me, as it surely would have done if I had waited until morning. Like flashes of lightning in a thunder-storm, these intellectual glimmers are extinguished with the same suddenness as marks their appearance.

“Whence do they come? Probably in my case they are the result of a habit formed by me very early in life, the habit of holding always in my mind something for it to feed upon, of supplying oil from an inexhaustible source to the lighted wick of my thought. If you wish to succeed in the things of the intellect, one sure way to do so is to think of those things incessantly.

“This was my practice far more than it was my

comrade's, which explains, without doubt, the exchange that was soon effected in our respective parts, the teacher becoming the pupil and the pupil taking the place of the teacher. But there was nothing fatiguing in this preoccupation that possessed me; it was not like the whip of the slave-driver, but rather was it a recreation almost as refreshing as, for example, the reading of a beautiful poem. In the preface to his volume entitled 'Lights and Shades' our great lyric poet says:

“‘Numbers enter into art as well as into science. Algebra enters into astronomy, and astronomy verges upon poetry. Algebra plays its part in music, and music lies on the borderland of poetry.’”

“Is that poetic exaggeration? No, certainly not. Victor Hugo spoke the truth. Algebra, the poetry of order, has its lofty flights. I find its formulæ, its strophes, superb; but I am not at all surprised that others should think otherwise. My colleague would have resumed his mocking manner if I had been so imprudent as to confide to him my very un-geometrical enthusiasms. ‘Piffle, pure piffle,’ he would have called them. ‘Let us get back to our tangent to the curve.’”

In this connection it is interesting to note that our “poet of science,” as Fabre has been called, wrote in his twenty-ninth year a long poem to which he gave the title “Arithmos” (the Greek word for “number”). It has thirty-seven six-line stanzas, all in glowing praise of mathematics, in the larger sense of that word. Apparently he got his inspiration, or at least took a hint, from the “great lyric

poet'' mentioned above. Until lately, so far as we know, this rather formidable essay in verse has remained in manuscript, without serious detriment to its writer's fame. He goes on to say, referring to his more prosaic companion in study:

''He was right, that ex-quartermaster: the strict requirements of the examination ahead of us barred out these reveries of a dreamer. But, on the other hand, was I so very far wrong? If we can borrow from the ideal a little warmth with which to take off the chill from the cold calculations of mathematics, if we can lift our thoughts above the prosaic rules and formulæ of that science, if, in short, we can animate the abstract with a spark of life, do we not thereby lighten the task of penetrating into the unknown? Where my companion in study plodded heavily on, disdaining the alleviations that for me banished all weariness, I, thanks to those alleviations, made the journey as if it had been a pleasure-trip. If I had the rude staff of algebra to lean upon, I had also as guide an inner voice calling me onward and upward. Study became for me a thing of festive delight.''

Then follows a rhapsody on conic sections—the ellipse, hyperbola, and parabola—which the less mathematically inclined reader might fail to appreciate; and, finally, we learn that after fifteen months devoted thus, in spare hours, to the mysteries of analytical geometry, the two young men appeared before the faculty at Montpellier and passed their examinations for the degree of bachelor of mathematical sciences. ''My companion,''' says Fabre,

“was worn out with his strenuous exertions, whereas for me analytical geometry had been a recreation.” He continues:

“Knocked out by his encounter with conic sections, my colleague declared he had had enough of it. In vain I tried to seduce him with the allurements of a still higher degree, that of licentiate in mathematical sciences, which would open the way for us to the glories of the higher mathematics and of the mechanism of the heavenly bodies. I could not kindle his ardor; he refused to have any part or lot in my audacious scheme. In his opinion it was a foolish undertaking that would only wear us out and would surely fail in the end. Without the guidance of an experienced pilot, he asserted, and with no compass but a text-book lacking often in clearness by reason of the brevity of its style and the rigid inflexibility of its technical terms, our poor bark could not but founder on the first reef. As well might one brave the ocean billows in a cockleshell.

“If not in these exact words, at least in others that were equally discouraging as to the extreme difficulty of my proposed undertaking, he explained to me why he declined to bear me further company. I was at liberty to get myself shipwrecked on a rugged and dangerous coast if I chose, but he, listening to the dictates of prudence, refused to accompany me.

“Now, I suspected another reason not openly acknowledged by the deserter. He had just won the diploma that his immediate purpose required, and

so what was the use of going farther? Was the mere pleasure of learning worth the midnight oil, the hours of severe application, that it would cost? He who, with no pecuniary profit in sight, yields to the blandishments of science, is a fool. So said my companion. Therefore let us retire into our shell, close our door to the importunities of the sunlight, and live the life of the mollusk. That is the whole secret of happiness.

“But that was not my philosophy. In my eagerness for fresh knowledge I saw in each stage accomplished merely a preparation for further advance into the unknown. And so my colleague left me, and thereafter I was alone, forlornly alone. No more refreshing and stimulating debates, in the still, small hours of the night, over the subject of our studies. Of those around me there was no one to understand me, no one to bring his thought into conflict with mine and to engage in that clash of wits by which flashes of truth are occasionally struck out, just as sparks are made to fly by the striking together of two pebbles.

“Henceforward, when a difficulty arose before me like a precipitous cliff, there was no friendly shoulder to lend its support while I strove to scale the height. Unaided I was forced to clamber up as best I could, falling often and then picking myself up, bruised and bleeding, to try the ascent once more. Alone, too, and without a word of friendly encouragement, I was to give my shout of triumph when, attaining the summit and battered by my

struggles, I was at last enabled to get a glimpse of what lay beyond.

“However, I had at the very beginning perceived that my mathematical campaign would mean much severe and solitary study. I was entering the domain of the abstract, and it was a rugged soil that had to be broken up with the sturdy plow of sustained mental effort. The blackboard, which had been just the thing for our curves and tangents when we two were studying analytical geometry together, was now discarded in favor of a notebook—a handful of folded sheets provided with a cover. With this faithful companion in my nightly toil, a companion that enabled me to pursue my studies in a sitting posture and thus rest my legs, I found that I could stick to my task until far into the night. Under my lamp-shade I kept the forge of my intellect at red heat, softening and hammering the obdurate mathematical problem.”

The reader will have noticed the rugged imagery so often and so effectively used in these reminiscences of a son of the soil. To one of the peasant class what could come more naturally than farming terms in any attempt at vividness and force of expression? The plow and the pick recur again and again, in a metaphorical sense, in Fabre’s writings. Terms used by blacksmiths, also, and words familiar to Alpine climbers are frequent. Thus does our naturalist give vitality and vigor to his style.

HIS LITTLE TABLE

A FURTHER intimate glimpse of the ambitious young student is furnished by Fabre himself in his half-humorous, half-affectionate memories of the little walnut table at which he used to sit, head in hands and elbows on the table, as he pondered the "obdurate mathematical problem" propounded by the text-book open before him. With occasional touches of whimsical exaggeration, or sometimes it may be whimsical under-statement, he thus gives us a view of his humble work-table and of its assiduously industrious owner:

"About the size of a handkerchief, with a penny ink-bottle at the right and an open note-book at the left, my work-table afforded me just room enough to ply my pen. I love that little piece of furniture, one of the first bits of personal property acquired by me when I started out in life as my own master. It is easily moved from place to place, as one wishes, either to a position before the window if it is a dark day, or into a shaded corner if the sun shines too brightly, or, in winter, to the fireside and the cheering companionship of a blazing log.

"Poor little walnut table, for half a century now, and more, I have remained faithful to you. Spotted with ink stains and scarred with the penknife, you

lend me your support while I write my prose, just as formerly you held my note-book while I solved my equations. This change of office is a matter of indifference to you, your patient back bearing with equal submission the formulæ of my first beginnings in algebra and the maturer literary product of my later years. I cannot say that I share this peaceful calm of yours. I find that the change from algebra to literary composition has not added to my repose, the pursuit of ideas disturbing the brain even more than did the hunt for the roots of an algebraic equation.

“You would not know me now, dear friend, if you could see my gray hair. Where is the not uncomely countenance of former days, flushed with hope and glowing with enthusiasm? I have indeed grown old. And on your part, too, what a wreck you have become since the day you came to me from the dealer’s all polished and shining and redolent of beeswax! Like your master you are plowed with furrows, the work of my hand, often, for in my impatience how many times have I scored you with my pen when the nib came out of the ink-bottle all muddy and refusing to make a decent mark!

“One of your corners is broken off, and the little boards that form your top are beginning to come apart. In your interior I hear, now and then, the gnawing of a wood-borer, that famous lover of old furniture. As the years pass, new galleries are excavated and your strength and firmness by so much diminished. The older excavations show from without in the shape of little round holes; and

these, offering as they do first-rate ready-made domiciles, are taken possession of by an intruder from outside. I catch a glimpse of the bold trespasser darting quickly under my elbow as I write and vanishing from sight in the tunnel left by the borer. It is an insect that hunts live prey, and it is of slender form and clothed in black. It is storing away a hamper of lice for its young. An insect tribe is housed inside you, my old table, and as I write a brood of larvæ is crawling about under my pen. I could ask for no more suitable writing-desk on which to jot down my entomological souvenirs.

“What will become of you when your owner shall have passed away? Will you be sold at auction when my heirs quarrel over my poor bits of property? Or will you perhaps be used to hold the water-pitcher at one end of the sink? Or, again, will your worn and battered top serve as a chopping-board on which to cut up vegetables for dinner? Or may it be that my family will come to an understanding and say, ‘Let us keep the thing as a relic. It was at this little table that he worked so hard to educate himself and fit himself to educate others. There it was that he wore himself out year after year in earning the wherewithal to feed and clothe us. Let us keep the thing as a sacred relic.’

“But I dare not expect any such future for you, little table. You will pass, my old friend and comrade, into the hands of strangers ignorant of your history and indifferent toward it. You will become, it may be, the night table in some sick-room, to hold medicines and cordials, until at last, rickety and

falling to pieces, you will be broken up to feed the fire for a few minutes under a pot of potatoes. You will go up in smoke to join my earthly labors in that other smoke, oblivion, the ultimate destiny of all our vain efforts and futile strivings."

Here it is of interest to record that the little table is assured of a far more honored old age than its owner ever dared to dream of. Fabre's old home has been bought by the French Republic to be preserved with all its contents as a public museum and an entomological experiment station. Fifty thousand francs was voted for the purchase, and two thousand for the first year's maintenance. The scarred and worm-eaten walnut table will be not the least interesting, not the least pathetically appealing, of the modest household possessions that surrounded "the master" in those many years of obscure research, of self-denying devotion to science, at Sérignan, whither this history will follow him in due course. Meanwhile let us hear him a little further on the subject of his earlier struggles and aspirations. He continues his narrative in this wise:

"But let us return, little table, to the days of our youth, the days of your fresh varnish and of my bright illusions. It is Sunday, day of rest; that is, of a good bit of work, with no classes to interrupt. I much prefer to Sunday, however, the weekly school holiday, Thursday, which is not a general holiday, and for that reason is better suited to the calm of undisturbed study. But, such as it is, and with all its distractions and dissipations,

the sacred day does give me some leisure. Let us profit by it to the utmost. There are fifty-two of these days in a year, almost equal in the aggregate to the long vacation.”

Then he settles himself to work at Kepler’s three laws of planetary motion, which some readers of this book—perhaps not many—may recall as requiring quiet concentration for their perfect mastery. But this uninterrupted calm was denied him, for, says he,—

“Suddenly in the distance I heard a resounding *brrum, brrum, brrum!* And it kept getting nearer and nearer, and louder and louder. Oh, for pity’s sake! Pox take that Chinese Pavilion!

“Let me explain. I was living in a suburb of Carpentras, on the road to Pernes and at some distance from the noise and confusion of the town. Ten paces from my abode, and directly opposite to it, there had just been established a tea-garden bearing the name of ‘Chinese Pavilion.’ To this resort on Sunday afternoons flocked the youths and maidens from the neighboring farms to kick up their heels in country-dances. In order to attract custom and promote the sale of refreshments, the proprietor used to wind up this Sabbath jiggling with a lottery; and for two hours beforehand, on all the public ways, he would cause the prizes to be paraded in conspicuous display, preceded by fifes and drums. At the end of a beribboned pole borne by a sturdy lad wearing a red woolen sash there dangled a silver-plated goblet, a roll of Lyons silk, a pair of candlesticks, and several bunches of cigars.

With such bait to lure one, who could keep away from the Chinese Pavilion?

“*Brrum, brrum, brrum!* went the big bass drum. The procession was now right under my window. It turned obliquely to the right and entered the pavilion, a spacious wooden shed hung with garlands of box foliage. If there was any one in the neighborhood with a preference for quiet, let him run away, and to a considerable distance. Until nightfall the ophicleides would bellow, the fifes would squeal, and the trumpets would bray. How in the name of reason was one to deduce the effects of Kepler’s laws in the pandemonium raised by such a wild African orchestra? It was enough to drive a body crazy. Away, then, as fast as legs could carry one!

“I knew of a deserted field a couple of kilometers distant, a stony piece of ground frequented only by fallow-finches and crickets. There I was sure to find perfect quiet and some stunted specimens of evergreen oak to lend me their scanty shade. I seized my book, with a few sheets of paper and a pencil, and fled to this solitude. Ah, what refreshing silence, what delightful quiet! But the heat of the sun was something terrific under the thin shade of the sparse foliage. However, brace up, my lad! Hammer away at Kepler’s laws, with the cheerful crickets to keep you company. You will go home at night with the problems solved, even though your epidermis be broiled to a crisp. You will pay for your mastery of the Keplerian laws with a burn on the nape of your neck, but it will be worth the price.

“In the rest of the week I had all Thursday for study, as also the evenings until drowsiness overpowered me. In fact, despite my bondage to the class-room I could not complain of lack of time. The one thing essential was to refuse to be discouraged by the inevitable difficulties at the start, for I easily got lost in that dense and tangled thicket through which I had to hack my way to the daylight beyond. After considerable groping and straying I would find the right path again, but only to lose it once more soon afterward. All the while, however, my sturdy ax kept at its work, but without always letting in very much daylight.”

Every student, and especially the self-taught student, will sympathize with Fabre in his occasional impatience with his text-book. How often it occurs that the one point above all others we wish the book would make clear is the very point it seems intentionally to avoid! One almost wonders at times whether the learned author is not himself puzzled by what puzzles the reader, and so evades the issue in order not to betray his ignorance. This suspicion is probably ill founded in most instances, but it at least affords the exasperated solitary student a little passing consolation. Here is how Fabre, from his considerable experience in self-education, views the matter:

“A text-book is a text-book, or, in other words, it is a brief, inflexible, unchangeable exposition of the subject in hand, very learned, I admit, but, alas, often obscure. The author seems to have written it for himself. He understands it; therefore others

ought to understand it. Let the poor novice, thrown on his own resources, find his way out of the tangle as best he can. For him there is no restatement of the problem in other words, no detour pointed out by the author for the sake of affording a less rugged road, no secondary opening by which a little light may find its way in and lessen the darkness. Immeasurably inferior to the spoken word, which can begin all over again as often as necessary and can attack the difficulty in various ways and from various directions until it yields to the assault, the book says what it says, and not a syllable more; and when the printed demonstration comes to an end the oracle is inexorably mute, whether you have understood or have not understood. You go back and read the text over again, you ponder it determinedly, you bring all your wits to bear on the meaning of the passage; but your efforts are of no avail, the obscurity refuses to be dispelled. Just what is it that is needed, in many cases, to light up the way before your feet? A mere nothing, a simple word; but that word the book obstinately withholds.

“Happy the student that has the oral instruction of a teacher to guide him. His progress knows nothing of those discouraging halts imposed upon the solitary learner. What was I to do when confronted by the pitiless wall that so often rose before me to bar my way? I followed the precept of *Alembert* in his advice to young mathematicians. ‘Have faith and press on,’ said the great geometrician.

“As for faith, I had it in full measure, and I

pressed on courageously. I was rewarded, too, in the end; for the light that I looked for in vain before the wall was often found by me behind it. Abandoning my first position, I would skirt the obstruction and gather explosive material on the other side of it with which to blow it up. At first perhaps I would find only a tiny grain of gunpowder, but by going on from theorem to theorem I would increase my supply until I had a powerful charge with which to hurl an irresistible projectile back against the at first invincible obstacle and thus clear it away and flood the whole path with light.

“There is much that is good, much that is excellent in *Alembert's* precept, provided it be not abused. Undue haste in pressing on, in turning the intractable page, would lead to many a disappointment. Before abandoning the difficulty one must assail it, tooth and nail. Out of a ruthless assault of this kind will come intellectual vigor.

“Twelve months of solitary study at my little table earned me at last the degree of licentiate in mathematical sciences; and so it came about, half a century later, that I found myself qualified for the eminently lucrative position of surveyor of spiders' webs.”

Thus, so far as the story can be told in a rather free rendering, *Fabre* pictures for us his method of learning a new subject without a teacher, of mastering by sheer grit and perseverance a science bristling with difficulties. Such resourcefulness and pluck, united with industry so untiring, could not fail of notable results in the development of his

talents and his character, even if they did not bring the rapid promotion and the material rewards that were their due. He passed in quick succession the examinations that secured him his two baccalaureate degrees and his licentiate in mathematics and the physical sciences. The licentiate, it may be well to explain here, is in France an academic grade between the baccalaureate and the doctorate, and it leads to the doctor's degree. Here, too, it will not be out of place to note that Fabre did not rest content until, in addition to the foregoing diplomas, he had won his licentiate in the natural sciences and his doctorate of science. Other titles, of an honorary nature, were conferred upon him in later life, as we shall see; but it would be as impossible to conceive of his caring very much for any of these dignities as it would be to imagine him dancing attendance, in court costume, on the French emperor or any of his ministers. Academic trappings were nothing to him except as possible aids in securing more congenial and more honorable as well as better-paid employment in his profession. How little they availed him in this respect will appear as we proceed with the story of his life.

Meanwhile it was becoming more and more difficult for him, with his pitiful salary of seven hundred francs a year, to make both ends meet. He had married, October 30, 1844, a young woman of Carpentras, Marie Villard, and they had one son. Other children were to follow, nor even in poverty were they unwelcome to their father, for he was a home-loving man with a heart full of affection for

his offspring. At this time, too, his father was meeting with his usual unsuccess in making a living. After various wanderings he had settled down at Pierrelatte in the department of Drome, not many miles north of Carpentras, and was again in charge of an eating-house. The other son, Frederic, was in the same neighborhood, so that the whole family was now, in a certain sense, reunited, with Henri as its real head. He it was that strove to preserve the family ties unbroken. He was counselor, arbiter, oracle, intercessor, and in trying situations a veritable father to the family. Hearing that his mother and his brother had had a falling out, he wrote to the latter in terms of gentle remonstrance, urging him to forget his petty grievances, if, indeed, he had any. Let us quote a few sentences.

“In one of his letters my father complains that, though you are so near by, you have not yet been to see them. I know well that there are some little disagreements, but what of that? Forget them and do your best to put an end to all these miserable little quarrels. You will, won’t you? I count upon it for the happiness of all.”

As if he were not already sufficiently tried by professional and personal and domestic problems and difficulties, the young teacher was at this time stricken in his tenderest spot by the sudden death of his first-born, for whom he was planning great things in the happy future to which he looked forward. But he resigned himself to the inevitable, with the calm fortitude of one who refuses to be-

lieve that this life is all, that there is not a happier one to follow.

“I weep,” he says, in some beautiful words addressed to the one he has lost, “because you are taken from us; but I rejoice because you are happy. You are happy, and this conviction is not the foolish hope of a father broken with sorrow; no, your last look told me that in a manner too eloquent to leave the shadow of a doubt. Ah, how beautiful you were in your mortal pallor, your last breath on your lips, your eyes turned heavenward, and your soul ready to fly to the bosom of God! Your last day was the most beautiful of all.”

Work and study were the bereaved father's refuge from grief and discouragement at this time. Indeed, they were at all times Fabre's unfailing resource, the panacea for all ills, if any such sovereign remedy were to be found. Peculiarly vexatious was the frequent delay in the payment of his meager pittance, a delay that often extended into weeks and even months. Education was not held in the highest esteem eighty years ago in France, and when the public funds ran short at Carpentras it was the school-teachers that were the last to receive their pay. “We have to besiege the door of the paymaster,” writes Fabre to his brother, “in order to get some little dribblets of our salary. I am overcome with shame and would willingly forfeit what is due me if I could raise a little money in any other quarter.” Fretting and chafing—for the French temperament has little of the imperturbable calm in

it—he vowed he would never again set foot in a communal college, that he must have a position less ridiculously unworthy of his acquirements. “Two licentiate degrees, and here I am teaching little brats to conjugate their verbs. It is too absurd!”

But he was forced to smother his indignation, to swallow his pride, and to continue at Carpentras a while longer.

CHAPTER VIII

BETTER FORTUNES

IT was not decreed that Fabre should wear out his life in teaching "little brats" their conjugations. Gradually his true destiny was to reveal itself, his own was to come to him, as it comes sooner or later to all of us, and congenial pursuits were to open before him more and more, even though he was to be haunted till near the end of his life by the fear of want, and at times by actual want itself.

A vacancy occurring in the department of physics and chemistry in the College of Ajaccio, in Corsica, he was invited to fill it. Exact dates, dates of any sort, in fact, are very seldom given by Fabre in his random reminiscences, and it is often difficult to determine the year in which this or that event occurred in his history. But he seems to have left Carpentras early in 1850 and to have held his position at Ajaccio until he was called to the Lycée of Avignon three years later. Corsica was not unknown to him; he had visited the island in boyhood, and its natural charms had made a lasting impression on him. Its luxuriant vegetation strongly attracted one devoted from infancy to the study of nature. Moreover, and not least important of all, the magnificent salary of eighteen hundred francs,

or something like a dollar a day in our money, was to be his material compensation if he accepted the post; and acceptance was not long delayed. We find him writing to his father from Ajaccio in April, 1850, expressing enthusiastic delight at his new surroundings. In a passage of glowing description he says:

“The boundless sea with its waves sparkling in the sunlight below me, the terrifying granite boulders above, the white town sitting coquettishly at the waterside, the endless stretches of myrtle with their intoxicating aroma, the rich undergrowth where plow has never passed, extending from the mountain’s base to its summit—all this makes a view so magnificent, so entrancing, that he who has once seen it would fain see it again and again, in endless repetition.”

The volcanic formation of the island offers him a spectacle of wild beauty that arouses his highest enthusiasm. Word-pictures are commonly tiresome enough, so much better can the painter do what the writer does but poorly at best; nevertheless another brief passage from Fabre’s glowing description of natural scenery may help us to see him in his new surroundings and at the same time illustrate his command of vivid and forceful language. After a full year in which to become accustomed to the chaotic grandeur of his environment he describes himself as still standing with amazement “before these granite heights gnawed by the harshness of the climate, jagged in their outline, rent and torn by the thunderbolt, and worn by the slow

but sure action of the piled-up snow; and before these abysmal chasms that fairly make one's head swim, these yawning gulfs in which howl the four winds of heaven, and these vast expanses of mountain slope on which the snow-drifts lie to a depth of ten, twenty, thirty meters, and down which meander little icy streamlets that, drop by drop, fill up the gaping craters and form lakes, black as ink when viewed in the shade, and blue as the azure sky above when seen in the light.

“But it would be impossible for me to give you the least idea of this dizzying spectacle, this chaos of rocks piled one on another in frightful disorder. When, closing my eyes, I recall these evidences of some former upheaval of the earth's crust, when in imagination I hear the eagles scream as they circle about in the boundless vault of heaven where the eye, hardly dares to follow them, I am seized with vertigo and am forced to open my eyes once more in order to reassure myself with the sight of the real world.”

With this letter to those at home he sent a few sprigs of immortelle gathered on the highest mountain-tops amid the eternal snows. “Put these into a book,” he wrote, “and when hereafter you turn the leaves and come upon these flowers, they will remind you of the awful sublimities amid which they grow.” So enraptured was he with this wild mountain scenery that he could hardly bear the thought of ever being obliged to exchange it for the dull monotony of a level country, where he feared he should die of ennui.

His eager and unflagging interest in the world without and the world within, in the vegetation and the sea-shells of Corsica as well as in the abstract ideas that filled his brain when he turned to mathematics, made the time pass quickly for him. He planned an exhaustive work on the conchology of the island, and tried to enlist his brother's coöperation in its preparation, but apparently with no great success. At any rate, the book remained unwritten, though its would-be author never lost his interest in the subject. Even in the hours when he should have been asleep his active brain was often busy with projects and speculations of a scientific nature. For several nights he was kept awake by the newly discovered properties of a geometrical figure. If ever man was "stung by the splendor of a sudden thought," this was a not infrequent occurrence with the young instructor in physics and chemistry at the College of Ajaccio.

But not yet had he found his true calling, nor was he to do so until after he was thirty years old. He did meanwhile, however, feel himself drawn more and more to the study of nature rather than to the further pursuit of mathematics and the physical sciences. The French botanist Requier, of Avignon, visiting Corsica for the purpose of cataloguing the plants of the island, fired him with added zeal for botanical research; and the entomologist Moquin-Tandon, professor at Toulouse University, also coming to Corsica at this time, kindled his enthusiasm for the study of insects. On the eve of his departure the professor remarked:

“You are interested in shells; that is something, but it is not enough. You must study animal life. I will show you how to go about it.”

Taking a pair of scissors from Madame Fabre’s sewing-basket near at hand, and hastily thrusting two needles each into a bit of vine shoot, he showed his breathlessly attentive young host the anatomy of a snail, dissecting the mollusk in a deep plate filled with water. One by one he explained and sketched the organs thus displayed. “And that,” says Fabre, “was the one and only and never-to-be-forgotten lesson in natural history ever received by me in all my life.” The incident had a powerful effect on him and marked the beginning of his gradually forming resolve to devote the rest of his life to the study of nature. “Geometricians are made, but naturalists are born,” he wrote to his brother just after this occurrence; “and you know better than any one else whether natural history has not always been my favorite science.”

Thenceforth he not only collected with enthusiasm dead specimens but dissected with still greater ardor the smaller forms of animal life, especially insects. “I dissect the infinitely little,” he wrote again to Frederic. “My scalpels are little daggers that I myself make out of small needles; my marble slab is the bottom of a saucer; and my subjects are kept by the dozen in old match-boxes.”

Meanwhile his rambles over the marshes in search of specimens had given him more than a touch of malarial fever, and after repeated attacks of the malady, accompanied by violent fits of shaking, he

found himself so enfeebled that he was obliged to ask for a speedy transfer to some other post of duty. Until an opening occurred he obtained leave of absence in order to recover his health, and returned to southern France. The crossing from Ajaccio to Marseilles was on this occasion unusually rough. How disagreeable it must have been to a passenger weakened by disease may be inferred from the following account sent by the hapless victim to his brother:

“Our passage was abominable. Never have I witnessed so terrible a sea, and if the boat was not smashed by the buffeting billows it was because our time had not yet come. Two or three times I thought my last hour had struck. You may imagine the frightful effect this experience had on me. Ordinarily the packet on which we crossed, and which is called the fastest boat on the Mediterranean, takes about eighteen hours for the trip from Ajaccio to Marseilles. This time it took three days and two nights.”

His health was gradually restored, and he went back to Ajaccio for a few months of further teaching at the college, at the end of which a call came to him (this was early in the year 1853) from the Lycée, or academy, as we should call it, at Avignon. The chair he was invited to fill was that of adjunct professor of physics, at a salary of sixteen hundred francs a year, or two hundred francs less than he had received at Ajaccio. He accepted, and for the next seventeen years, with a family increasing in

size until they "sat seven at table," he had to live as best he could on this meager income. No promotion, no slightest addition to his pay except as he might occasionally earn it by outside work, and no promise of better things to come or even of a retirement pension or of a pittance to his family in the event of his death, contributed to lessen his anxieties and make him more content with his lot during this period.

But Fabre was a born teacher as well as a born naturalist. To teach others while learning himself was his never-failing joy. He both knew how to make himself respected and obeyed by his pupils and was master of the more difficult art of comradeship with his young disciples. Their guide and mentor, he was at the same time their fellow-student, calling them by their first names, seeing things as they saw them, giving them his sympathy and affection, and at all times inciting them to their best endeavors. Even the failures and the laggards from other classes caught the fever of ambition when they joined his, and became earnest workers like their companions. It was a generous and a joyous emulation that he inspired in all who came under his teaching. A curious testimony to the effectiveness of his methods is found in the fact that, with all his ease and friendliness of bearing and his seeming disregard of professorial dignity, he was held in such respect by those about him that he alone of all the instructors had no nickname applied to him. He was "Professor Fabre" and

never anything else. Students of this day and generation do not need to be told how rare such a distinction is in academic life.

It was at about this time that Fabre passed his examination, already referred to, in the natural sciences. This took place at Toulouse, before the professors of the university there, and appears to have been an oral and not a written performance. One of the questions asked had to do with the theory of spontaneous generation, the taking on of life by lifeless matter, and it chanced that the examiner was an ardent advocate of the doctrine. This was before the painstaking researches of Pasteur and Tyndall and others had undermined this once plausible theory. But the young teacher from Avignon was not afraid to come to grips with its most sturdy advocate, and so ably did he defend his position that even those who disagreed with him were forced to admire the independence and originality of his genius. He passed his examination with distinction. In his account of the event to his brother he says, exultantly, under date of August 1, 1854:

"I have just returned from Toulouse, where I passed as good an examination as one could possibly desire. I received my licentiate with the most flattering compliments, and I am to be reimbursed for my examination expenses. The examination attained a high level quite unexpected by me."

Again and again in Fabre's life and writings we find him protesting eloquently and persuasively

against any mechanical interpretation of the wonders of creation. His was an eminently devout and reverent habit of mind, even if he did spend his Sundays in hard work, in intellectual rather than devotional pursuits. He has dwelt with much emphasis on what seemed to him the insufficiencies of the Darwinian mode of accounting for animal traits. An ever-present divine intelligence rather than blind chance controls the world of animate beings, in Fabre's opinion; and this opinion was sturdily declared and defended by him long before either the strength or the weakness of Darwinism had been as carefully demonstrated as they were to be later. The two great natural scientists, Darwin and Fabre, admired and respected each other, and they were entering upon an unusually interesting correspondence when the older man died and the younger was left to mourn his loss and to bear witness to his achievements. There was never any trace of rancor in his attack upon theories that seemed to him erroneous. "I wage war boldly," he declares, "against ideas that I believe to be false; but God forbid that I should ever do so against those that hold them."

A question of considerable interest arises at this stage of our young professor's career. Why, after qualifying himself thus far in mathematics and the physical and natural sciences, did he not go on, as he was encouraged to do by the Toulouse faculty, and take the additional degree that would have entitled him to apply for a university professorship?

It was a dignity he had apparently been longing to attain in order to rid himself of the drudgery of elementary instruction. Well, as Emerson says,

Deep in the man sits fast his fate
To mold his fortunes mean or great.

Something within whispered to the budding naturalist that his true path lay through the fields and woodlands, where animate nature could be studied and enjoyed in its native freedom and profusion, rather than among the haunts of academic culture and the abodes of cut-and-dried erudition. Or, to put it more simply, Fabre was a free spirit and could endure no fetters. His contempt for meaningless conventions, his refusal to wear the costume of fashionable society, his abhorrence of subserviency, of flattery, of place-seeking—these rugged qualities had unquestionably retarded his advance in a worldly way, and would to the end have counted against him in the struggle for high position. His broad-brimmed black felt hat and his peasant jacket were too dear to the country-born and country-bred nature-lover to be exchanged for any less free-and-easy attire; and his thousands of readers and admirers have reason now to be thankful that he made his choice as he did.

What finally turned him to entomology as his specialty in the broader field of natural history was an occurrence that we should call mere chance if we did not feel assured that human destinies are not ordered in any such haphazard fashion. The occurrence came just when Fabre was ripe to

perceive its significance. One evening in the winter of 1854 a treatise by the celebrated entomologist Léon Dufour fell into his hands. He read it, and it kindled the flame that was never thereafter to die down in his breast. It had to do with a certain kind of wasp in whose nest the writer had found some small insects that, though apparently lifeless, yet retained their color and freshness for an incredibly long time. Even though the young of the wasp, the recently hatched larvæ, fed on these insects, nibbling them gradually until the vital organs were finally reached and devoured, there was no sign of mortification, no decay, no spoiling of the provisions before they were all used up. Naturally Dufour was struck by this puzzling situation. He assumed that the victims were dead, and he sought an explanation of their keeping so well. He concluded that the mother wasp, in stinging them, must have injected some sort of embalming fluid that preserved them from decay during the time needed for the purpose in view, the feeding and maturing of the larvæ.

But Fabre was not convinced. He determined to look into the matter himself. On doing so he was surprised to find how far from the truth the "patriarch of entomology" had strayed in his attempted solution of the mystery. What Fabre discovered forms one of his chief contributions to entomology: the secret of the prolonged freshness of the animal food supplied to the larvæ lay—or at least so he became convinced—in the mother wasp's art of stinging her victim in a nerve center and thus

paralyzing the insect without causing its death. It is a secret not possessed exclusively by the wasp, however, as further research was to make known to the painstaking investigator; and the account of this further inquiry furnishes some of the most interesting reading in the ten volumes of "Souvenirs" that Fabre in later life gave to the world, and that have supplied material for a number of translated works such as "Social Life in the Insect World," "The Wonders of Instinct," and "The Life and Love of the Insect." It was this first inquiry into the soundness of Dufour's conclusions that revealed to the astonished investigator how vast was the field of half-knowledge and even of downright ignorance in the realm of insect-study. He heard and heeded the call to enter this field and lay it open to others. For threescore years he was destined to toil tremendously and enthusiastically at this all but solitary task. It was his distinction to be the first to achieve results of the utmost importance in the study of the living insect and its habits. Before him classification according to anatomical structure and the collecting and preserving of lifeless specimens had been the all-sufficient function of the entomologist. To Fabre it was the living and not the dead specimen that was of interest, and he communicated this interest to thousands of others.

What could he have accomplished in this difficult and exacting department of research if he had yielded to his earlier ambition for a university chair from which to lecture on mathematics and the

physical sciences or, as he afterward preferred, on plants and animals? Here let us note the title of the paper published by him in "*Les Annales des Sciences Naturelles*" ("*Annals of the Natural Sciences*") in 1855, as the first of many chapters from his pen on insect habits. The article, which gave his solution of the problem that had baffled Dufour, was called, in a literal English rendering, "*Observations on the Habits of the *Cerceris* and the Cause of the Long Preservation of the Coleopters with which It Feeds Its Larvæ*"—a rather formidable title of what is really a simple and clearly written account of a most interesting investigation.

It should in candor be added here that of late Fabre has been accused of some inaccuracy in his account of the matter just referred to. Even he, the avowed enemy of beautiful but baseless theories, may at time have been carried away with enthusiasm for a plausible but inconclusive solution of a long-standing riddle. His early training in mathematics, physics, and chemistry may have made him a little too ready to see clean-cut laws in the natural world around him, where such laws are not always to be found. Nevertheless his questioning of the soundness of Dufour's theory did lead him to notable discoveries of his own.

This whole question of the originality and worth of Fabre's contribution to the science of entomology will for some time remain a more or less open question, and no attempt will here be made to close it. Let it suffice to end this chapter by quoting

from one of his most recent and most authoritative critics the following estimate of the value of his work as an entomologist:

“He is, indeed, so preëminent in the wealth and precision of his observations, in the ingenuity of his experimentation, and in literary expression, that his ‘Souvenirs’ will always endure.”¹

¹ Professor William Morton Wheeler, as quoted by Dr. Leland O. Howard in an article entitled “A Pilgrimage to the Home of Fabre,” in “Natural History” for July-August, 1922. Dr. Howard also notes Wheeler’s criticism of Fabre’s too scientific habit of mind.

CHAPTER IX

TRIALS AND TRIBULATIONS OF A NATURALIST

LET us try to catch a glimpse of our enthusiastic naturalist in his daily round of duties and diversions (if there were any diversions) during those busy years at Avignon that followed the scarcely less busy years at Ajaccio.

Besides his regular class-room work, which was by no means light, and his private tutoring—undertaken to eke out his scanty salary and continued with much inward protest—he managed to find time, on the weekly no-school day (Thursday) and on Sunday and other holidays, to roam the fields in quest of insects and in the study of their habits. He would cheerfully spend a whole day in the hot sun, patiently waiting and watching in order to determine just how a mason-bee, for instance, provisioned its nest, or with what love-compelling blandishments the male scorpion courted the favor of his sweetheart; for no amount of insect-study in a museum of dried or embalmed specimens was of any account, in his opinion, if one wished really to know these little inhabitants of our woods and meadows. He says, in a characteristic passage:

“An insect is caught, a pin is thrust through it; then the pin is stuck into the cork bottom of a little

box, and under the feet of the specimen is placed a small card bearing a Latin name; and that ends the chapter for that insect. But this way of studying entomology does not satisfy me. It is of no use telling me that such and such a species has so many joints to its antennæ, so many veins in its wings, so many hairs on a particular part of its abdomen or of its thorax; I do not really know the little creature until I have learned its way of life, its instincts and its habits."

His mode of studying these instincts and habits may be gathered from still another characteristic passage. This and the following extracts do not all refer necessarily to the Avignon period, but they may well enough be grouped together here as illustrating Fabre's methods of field work and some of the incidental annoyances he met with in the course of that work.

"The scene," he says, "is laid on the banks of the Rhone. On one hand is the great river and the murmur of its rushing waters, on the other a dense growth of osiers and reeds and willows, while between the two runs a narrow path strewn with fine sand. A digger-wasp with yellow wings comes hopping along, dragging its prey on the ground. What do I see? The prey is not a cricket, but only a common locust, and yet its captor is surely the digger-wasp so familiar to me, the yellow-winged digger-wasp, the zealous hunter of crickets. Scarcely can I trust the evidence of my senses.

"The wasp's burrow is not far away. The insect goes in and stows its booty. I sit down and



Photograph by L. O. Howard

FRONT VIEW OF FABRE'S HOUSE

make up my mind to wait for the wasp to sally forth on another hunting-expedition; I am resolved to stay there for hours if need be, so that I may see whether the extraordinary capture will be repeated. In my sitting posture I take up the whole width of the path. Two clumping conscripts come striding down the footway, their hair cut short and their gait marked by that indescribable machine-like jerkiness that betokens early training in barracks. They are chatting together, about home and their sweethearts, no doubt, and each is scraping the bark from a willow switch with his jack-knife as they walk along. A sudden fear seizes me, for it is not so easy as it might be to conduct one's investigations on a public way where, when the event arrives that one has waited for during long years, the passing of a stranger may nullify the lucky chance that will perhaps never occur again. In dread of some such mishap I rise to my feet and make room for the conscripts to pass. I press back into the osier thicket and leave the path clear. To do more would have been imprudent. If I had said, 'My good lads, don't step there, please,' I should only have made matters worse, they would have suspected a trap hidden under the sand, and questions would have followed to which I could have given no answers satisfactory to them. My request, too, would have saddled me with the company of these two idlers, a company very embarrassing to one engaged in such studies as mine. I rise, therefore, without speaking and trust to my lucky stars. Alas, my lucky stars betray me; the heavy army boot comes crunch-

ing down exactly on the roof of the digger-wasp's burrow. A shudder runs over me as if I myself had been trampled on by the hobnailed foot-gear."

And so that problem in wasp habits was left unsolved, for both the burrow and its proprietor were severely damaged. "Another, more fortunate than I, may some day settle the question," is Fabre's concluding comment on the incident. He points out the peculiar difficulties met with by the naturalist in his researches as compared with the chemist, for example, and very aptly remarks:

"When the chemist has planned his experiment in every detail, he proceeds, at the moment best suited to his own convenience, to mix his chemicals and light a fire under his retort. He is master of his time, chooses his scene of action, arranges all his details. At the appointed hour he shuts himself up in his laboratory and makes sure that he shall not be interrupted in the course of his operations. He orders circumstances to suit his needs. With chemical agents to assist him, he pries into the secrets of inanimate nature.

"But the secrets of living nature—not those of anatomical structure, but rather those of life in action, and especially those of instinct—impose on the investigator conditions of a very different and much more difficult and delicate sort. Far from being able to arrange the time to suit his convenience, he is the slave of the seasons, of the day and the hour, of the precise second, even. If the wished-for opportunity presents itself he must seize it promptly, for it may never recur; and as it has

a way of presenting itself when one is least expecting it, nothing is in readiness for taking advantage of it. One must improvise on the spot such little implements as may be needed, order one's plans, decide on one's tactics, and devise the necessary artifices, only too happy if inspiration comes promptly enough to make it possible to take advantage of the lucky chance. That chance, too, is hardly likely to offer itself except to the one who is incessantly on the lookout for it. And so one must be on the watch for days and days at a time, now on a sandy slope exposed to the scorching heat of the sun, now in the stifling atmosphere of some byway hemmed in by high embankments, and now on some overhanging projection of gravel formation that gives little promise of stability. If you can fix your post of observation under a scrawny olive-tree that affords you even a scanty shade from the implacable sun, thank the kind fortune that thus favors you; your lot is a veritable Eden. Above all, do not relax your vigilance. The situation is favorable to your purpose and—who knows?—the awaited event may occur at any moment.

“At last it does occur, after long waiting, indeed, but still it does come in the end. And now if you could only sit and observe at your ease, in the quiet of your study, all alone, all absorbed in the matter in hand, far from any importunate passer-by who, seeing you intently gazing at a spot where he sees nothing, stops and plies you with questions, taking you for some searcher after hidden springs, some master of the divining-rod, or perhaps, worse still,

looking upon you as a suspicious character practising the black arts and seeking by incantations to disinter buried treasure! If, however, you have in his eyes the appearance of a Christian, he will accost you, look where you are looking, and then will smile in a way to leave no doubt as to his poor opinion of those who spend their time watching flies. Lucky for you if the unwelcome visitor merely goes away laughing in his sleeve and does not upset all your carefully laid plans—does not repeat the disaster of the hobnailed boot.

“If it is not some idle passer-by whose curiosity is aroused by your mysterious occupation, it will be the rural constabulary, the stern representative of the majesty of the law out there in the fallow fields. For some time the eye of the law has been upon you. The constable has so often seen you wandering about hither and thither like a lost soul without any apparent end in view, he has so many times come upon you rummaging in the ground or tapping cautiously the steeply sloping bank of a sunken road, that at last his suspicions are aroused. In his eyes you are nothing but a tramp, a vagabond, a suspicious-looking prowler, a marauder, or at the very least an idiot. If you happen to be carrying your case for holding botanical specimens, he takes it for a poacher’s ferret-box and will not be persuaded that you are not emptying all the rabbit-holes in the neighborhood, in defiance of the hunting-laws and in violation of the rights of ownership. Be ever on your guard. However thirsty you may be, lay not a finger on the grapes that you

chance to pass; for the wearer of the municipal badge would pounce upon you, only too glad of an excuse for questioning you if he may thus obtain, at last, an explanation of your extremely puzzling conduct.

“I can affirm with a clear conscience that I have never been guilty in this wise, and yet one day as I was lying on the sand absorbed in the details of a digger-wasp’s housekeeping, all at once I heard a voice at my side: ‘In the name of the law, I arrest you!’ It was the rural constable, who, after long waiting in vain for a chance to catch me in some misdeed, and being every day more and more tormented with curiosity as to my mysterious behavior, had finally decided to hale me into court without further ceremony. I tried to explain matters, but the poor fellow appeared to be not at all convinced.

“‘Bah!’ said he; ‘never try to make me believe you come out here and roast in the sun just for the fun of watching flies. I shall keep an eye on you; mind that! And if you don’t look out for yourself—well, you are warned.’

“With that he left me, and I have always believed that my red ribbon¹ had a good deal to do with his going. To this same ribbon I am indebted for other little services of a similar sort in the course of my entomological and botanical rambles. It even seemed to me—or was it only illusion?—that in my botanizing on Mt. Ventoux my guide was

¹ Badge of the Legion of Honor. Fabre’s account of its unexpected bestowal will be found in Chapter XIII.

more affable and my donkey less intractable because of my ribbon. Nevertheless my little band of scarlet has not always saved me from the tribulations common to the entomologist who plies his calling on the public highway. I will cite an instance, a typical one.

“Ever since daybreak I had been sitting, in watchful waiting, on a stone at the bottom of a ravine. The digger-wasp of Languedoc was the subject of my morning’s study. Three women, grape-pickers, passed me on their way to the vineyards. Glancing at the man sitting there apparently lost in thought, they gave him a polite ‘good morning,’ which he as politely returned. At sunset the same three grape-pickers passed again on their homeward way, their heaped-up baskets on their heads. The man was still there, sitting on the same stone, his eyes turned upon the same spot. My immobile attitude and my long-continued station on that one spot, all alone, must have struck them as something very extraordinary. As they passed me I saw one of them touch her forehead with her finger, and I heard her whisper to the others in their patois:

“ ‘A poor innocent. Oh, poor man!’

“Then they all three crossed themselves.

“ ‘An innocent’ she had called me, ‘an innocent,’—that is, an idiot, a poor devil, harmless but bereft of his reason,—and they had all three made the sign of the cross, an idiot being in their eyes marked with the seal of God.

“ ‘What!’ I exclaimed to myself. ‘Oh, cruel

irony of fate! You who prosecute these painstaking investigations in order to determine what is instinct and what is reason in animal life, you have lost your own reason in the eyes of those good women. What a humiliation!’ But I did not take it to heart. The words, ‘Oh, poor man!’ uttered in accents of sincere commiseration from the bottom of the speaker’s kind heart soon made me forget the ‘poor innocent.’ ”

Like all ardent truth-seekers in whatever field of inquiry, Fabre was filled with triumph whenever he succeeded in proving the soundness of a cherished theory—whenever facts were found to tally with previsions. The importance of the issue did not so much matter; it was the definite establishment of some new bit of scientific truth that made the investigator happy. On one occasion Fabre had reason, based on previous experiment, to suspect the existence of a certain parasite on a certain kind of mason-bee. To verify this suspicion he visited, on a cold and rainy day, a spot where the bees in question were known to have their cells. Here is his exultant account of the glorious outcome of his expedition:

“I will confess that it was not without some quickening of the pulse that I found myself once more facing the steep bank where the mason-bee makes her abode. What was to be the issue of my investigation? Should I again be covered with confusion? The weather was cold and rainy, and not a single honey-gatherer was to be seen on the few spring flowers that were in bloom. At the en-

trance to their galleries were crouching numerous mason-bees, benumbed and motionless. With a pair of nippers I drew them, one after another, from their lurking-places and examined them through a magnifying-glass. The first proved to have larvæ of the blister-beetle on its thorax; the second likewise, as also the third and the fourth, and so on, as far as I chose to carry the investigation. I examined other galleries, to the number of ten, twenty, and always with the same result. Then it was that I experienced one of those moments such as come to men who, after turning an idea over and over in their mind for years, and after considering it from every possible point of view, are at last in a position to cry, 'Eureka!' "

An incident of quite another sort, but even more significant and interesting in its final results, occurred at about this time. One day there unexpectedly entered Fabre's class-room, where he was teaching geometrical drawing, the mathematician Rollier, who held the office of inspector-general, and who went by the uncomplimentary nickname of "the crocodile" among the colleagues of our young professor. But under the exterior coldness and harshness of the reptile there seems to have lain a warm heart, as Fabre soon had reason to acknowledge. After the lesson was over and the class had been dismissed, there was some conversation on geometry, and the drawings of a peculiarly talented pupil were brought forth in the hope of interesting the great man. But to the instructor's dismay the

inspector-general remained coldly unresponsive, true to his crocodile reputation, and even worse things were apprehended. The alarm, however, turned out to be baseless; for the reptilian coldness suddenly turned to human warmth and geniality. Rollier seated himself astride of a bench and invited Fabre to take a seat beside him. Then, briskly:

“‘Have you any property of your own?’ he asked.

“‘Abashed by the unexpected question, I merely answered with a smile.

“‘Don’t be afraid,’ said he; ‘confide in me. I am asking you this in your own interest. Have you any property?’

“‘I do not need to blush for my poverty, sir,’ I replied. ‘In all frankness I confess to you that I have nothing. My resources are limited to my humble salary.’

“‘A frown was the only answer to this, though I heard him mutter to himself: ‘That ’s a pity, a great pity.’

“‘Surprised that my impecunious condition should be commiserated by my august visitor, I asked him for an explanation. I was not used to such solicitude from my superiors.

“‘Yes, it is a great pity,’ continued the man who was reputed to be so unsympathetic. ‘I have read your articles in the “Annals of the Natural Sciences.” You have an observant mind, a taste for research, a vivid style, and a nimble pen. You would have made an excellent university professor.’

“‘But that is exactly what I wish to be.’

“ ‘Give it up.’

“ ‘Do you mean that my scholarship is not up to the standard?’

“ ‘No, no; your scholarship is all right, but you have no private means.’

“ ‘The insuperable obstacle was revealed to me. Woe to the poor! Advanced teaching calls for an independent income on the teacher’s part. No matter how mediocre, how commonplace you may be, if you have the ducats you can cut a figure. That’s the chief thing; all the rest is secondary. The worthy man told me a thing or two about poverty in broadcloth. Though less destitute than I, he had known something of the embarrassments that go with insufficient means, and with much feeling he pictured them to me in all their unloveliness. Broken-hearted, I listened to him, seeing the while the downfall of my hopes for the future.

“ ‘Monsieur,’ I rejoined, ‘you have done me a great service; you have put an end to my hesitation. For the present at least I relinquish my purpose, and before resuming it I will see whether I can scrape together the modest fortune necessary if one wishes to fill a university professor’s chair in a becoming manner.’

“ ‘With that we exchanged a friendly hand-shake and parted, and I have never seen him since. His arguments, put before me in a fatherly fashion, carried quick conviction, my mind being ripe for the truth in all its harshness. A few months before this conversation I had been notified of my nomination to fill the chair of zoölogy at Poitiers. The salary

attached was ludicrously small, so small, indeed, that after paying the costs of moving I should have had remaining barely three francs a day on which to support my family of seven persons. I hastened to decline the distinguished honor."

Since that was written there has been a change for the better in the pay granted to teachers and professors in France; but when the new order was instituted it was too late for Fabre to profit by it. "When the pear was ripe," he says, in melancholy retrospect, "I was too old to pluck it."

CHAPTER X

FABRE AS MOUNTAINEER

AN extremely interesting incident in Fabre's life at Avignon is related by him, in his own inimitable manner, in the first volume of the "Souvenirs." He devotes an entire chapter to his twenty-third ascent of Mt. Ventoux, an outlying peak of the Alps, six thousand two hundred and seventy feet high, situated about fifteen miles north-east of Avignon. This ascent, as the narrative shows, came somewhere near to being the narrator's last exploit of any sort, as it must have been the most exciting and the most remarkable of the numerous climbs he made up that rather forbidding slope.

It was only his resourcefulness, his varied knowledge, and his quick-wittedness that saved himself and his party from probable death or at least serious injury. This memorable experience illustrates in a curious manner how an acquaintance with plants may avert very serious accident when one is lost on a mountain-top. The narrative, too, helps the reader to understand how it is that the author of "This Earth of Ours" has been able to enliven the pages of that book with some unusually vivid and absorbing descriptions of Alpine mountaineering. Fabre says:

“By reason of its isolation, which leaves it exposed on every side to atmospheric influences, and because of its height, which makes it the culminating point of France this side of the frontiers, whether those defined by the Alps or those other natural boundaries formed by the Pyrenees, Mt. Ventoux, the bald peak of Provence, is admirably adapted to the study of the distribution of plant species according to climate. At its base flourish the warmth-loving olive-tree and those innumerable small plants of a half-woody nature, such as thyme, whose aromatic fragrance requires the sunshine of the Mediterranean coast, while on the summit, which is covered with snow during half the year, the soil supports a flora characteristic of northern latitudes and borrowed in part from the arctic regions. A half-day’s climb up the side of the mountain will enable one to pass in review a succession of plant types such as would be met with in a long journey from south to north along the same meridian.

“On starting out to ascend Mt. Ventoux your feet press the balsamic clumps of thyme with which the lower reaches of the mountain-side are carpeted. A few hours later they will tread somber masses of saxifrage, the first plant to be encountered by the botanist landing in July on the shores of Spitzbergen. At the base, among the hedges, you picked the pomegranate’s scarlet blossoms; up there toward the summit you will pluck a little hairy poppy whose stems are incrustated with fine fragments of stone. Its wide

yellow corolla is found in the icy solitudes of Greenland as well as on the upper slopes of Mt. Ventoux.

“Such contrasts have a never-failing novelty; and so twenty-five ascents of the mountain have not left me satiated. It was in August of the year 1865 that I made my twenty-third. We were a party of eight, three of whom were incited by motives relating to botany, and five by a desire to climb the peak and enjoy the view from its summit. Not one of my five non-botanical companions of that ascent has since shown any desire to accompany me a second time. The reason is that the ascent is laborious and the sight of a sunrise at its end does not pay for the fatigue.

“No more apt comparison could be made than to liken Mt. Ventoux to a heap of crushed stone for road-building. Let the heap rise boldly to the height of two kilometers, give it a base of proportionate amplitude, sprinkle the white limestone with dark patches to represent forest, and you will get an idea of the mountain’s general appearance. This pile of mineral fragments, which are in some places nothing but little chips and splinters, in others enormous blocks, rises abruptly from the plain, with no preliminary slopes, no successive terraces, to make the ascent easier by dividing it into stages. The climb is a climb in good earnest from the very first, by rocky paths of which the best are inferior to a road newly strewn with crushed stone, and continues with ever-increasing ruggedness to the summit, nine-

teen hundred and twelve meters above sea-level. Pleasant greensward, babbling brooks, moss-covered boulders, the refreshing shade of stately trees centuries old—all these things, which add so much charm to other mountains, are here unknown, and in their place we have an unrelieved stretch of limestone broken up into scales that slip from under the feet with a clinking sound that is almost metallic. The cascades of Mt. Ventoux are cascades of stone: the clatter of displaced pebbles is heard instead of the murmur of running water.

“Here we are, then, at Bédoin, right at the foot of the mountain. Our arrangement with the guide is completed, the hour for starting is agreed upon, the question of food supplies has been discussed, and the needed provisions are being prepared. Let us try to get a little sleep, for we shall have to spend the next night on the mountain with very little closing of eyes. To get a few winks of sleep before starting—that is the difficulty. Never have I been able to achieve that necessary rest, which goes far toward explaining the fatigue I have experienced in the ascent. I would therefore advise those of my readers who are planning a botanical expedition to the top of Mt. Ventoux not to preface their climb with a Sunday night at Bédoin. By heeding this counsel they will avoid the noise and confusion of an inn and restaurant combined, the endless conversations in loud voices, the clicking of billiard-balls in the billiard saloon, the tinkling of glasses, the songs that follow the

drinking, the midnight vocal efforts of passers-by, the braying of brass instruments from the adjacent dance-hall, and other tribulations inevitable on this sacred day of idleness and mirth. Are conditions likely to be more favorable on a week-day? I wish it might be so, but I have my doubts. For my part, I did not on this occasion get a wink of sleep. All night long the rusty spit operating for our benefit creaked and squeaked just under my bedroom. I was separated from the devilish machine by only a thin board floor.

“But dawn comes at last. An ass brays under our windows. We must get up, for it is time to start. We might just as well not have gone to bed. Provisions and other luggage are loaded on to our beasts of burden. ‘Giddap!’ cries the guide, and we are off. It is four o’clock in the morning. At the head of the caravan marches Triboulet with his mule and his ass, Triboulet the dean of Mt. Ventoux guides. By the uncertain light of early dawn my botanical colleagues examine the plants that grow along the way. The others chat together. I follow the little company, a barometer slung over my shoulder, a note-book and pencil in my hand.

“Gradually, as the temperature becomes too cold for them, certain trees and plants cease to show themselves by the wayside. The first to disappear are the olive-tree and the evergreen oak, then the almond, and after that the mulberry-tree, the walnut, and the white oak. Box becomes abundant, and we enter upon a monotonous stretch that extends from the upper limit of cultivated plants

to the lower limit of the beeches, and that has as its chief representative of plant life the mountain savory, known here by the vulgar name of asses' pepper, from the sharp flavor of its very small leaves, which are impregnated with an essential oil. Certain small cheeses included among our provisions are seasoned with this strong spice. Already more than one of our party is biting into them in imagination, and more than one is casting hungry glances at the saddle-bags containing them and borne by the mule.

“Our vigorous morning exercise has given us an appetite; yes, more than an appetite, a devouring hunger, or what Horace calls *latrantem stomachum*, a barking stomach. I show my companions how to ease this gastric anguish until the next halt, which is not far ahead; I point out to them, amid the stones by the wayside, a tiny sorrel with arrow-shaped leaves, the *rumex scutatus*, and suiting my action to my words I pick a mouthful of the plant. At first they only laugh at me, but I let them laugh, and pretty soon I see them all engaged in gathering the precious sorrel.

“While we are chewing these acid leaves we reach the beeches, which at first are nothing but good-sized bushes, scattered here and there and trailing their branches on the ground. Soon, however, they become dwarf trees, closely grouped, and finally these give place to trees with sturdy trunks, a dense and somber forest growing out of a chaos of limestone rocks. Overladen in winter with masses of snow, buffeted throughout the year by the furious

north wind, many have suffered the loss of branches, and many are twisted into the oddest shapes or even laid prostrate on the ground. It takes us more than an hour to pass through this wooded zone which from a distance looks like a black girdle encircling the mountain. At last we are at the upper limit of this growth of beeches, and, to the great relief of all, even though we have been chewing sorrel leaves, we are also at the spot chosen for our halt and lunch.

“We have reached the spring of La Grave, a mere thread of water that on issuing from the ground is received in a series of long troughs hollowed out of beech trunks. To this spot the shepherds of the mountain drive their flocks and let them drink. The temperature of the spring is seven degrees centigrade, a coolness highly appreciated by us after the dog-day heat of the plain. The tablecloth is spread on a charming carpet of Alpine plants, the provisions are taken out of the saddlebags, and the bottles removed from their couch of hay. On one side is placed the chief course of the meal, the legs of mutton stuffed with garlic, and the piles of bread; on the other the chickens, less toothsome but good for exercising the grinders after the appetite’s first sharp edge has been dulled; not far away, in a place of honor, are the little Ventoux cheeses flavored with mountain savory or asses’ pepper; beside them we see sausages from Arles, their pink substance interspersed with little cubes of bacon and whole grains of pepper; yonder corner is occupied by green olives still dripping with brine,

and black olives preserved in oil; in that other corner are melons from Cavaillon, some with white flesh and others with orange, for all tastes are catered to; this corner here holds the pot of anchovies, a fine thirst-provoker; and, finally, the bottles of wine stand cooling in the icy water of one of the troughs. Has anything been overlooked in this catalogue? Yes, the main feature of the desert—onions to be eaten raw with a sprinkling of salt. Our two Parisians, for there are two in our company, are at first a little taken aback at beholding this superabundant spread; but they will soon be the first to voice their approval in eloquent eulogy. Everything is in readiness. Now take your places around the cloth.

“Therewith begins one of those Homeric banquets that linger in the memory as long as one lives. The onslaught is little short of frantic. Slices of mutton and hunks of bread disappear, one after another, with alarming rapidity. Without communicating his fears to others, each one gives an anxious look at the diminishing store of provisions and says to himself: ‘If this keeps up shall we have anything left for our evening meal and for tomorrow?’ Meanwhile the wolfish hunger is getting itself appeased, and whereas at first we devoured our food in silence, now we talk as we eat. Apprehensions for the morrow are also calming down. We acknowledge the wise prevision of our commissary, who foresaw this devouring hunger of ours and made arrangements to satisfy it in a worthy fashion. Now the moment has arrived for savor-

ing the delicacies after the manner of a connoisseur. One praises the olives, which he takes up, a single olive at a time, on the point of his knife; another extols the anchovies, cutting up the little ochre-colored fish as he does so and spreading the pieces on his bread; a third has an enthusiastic word to say for the sausages; and, finally, all join in unanimous commendation of the cheeses no larger than the palm of your hand. Then pipes and cigars are lighted and all throw themselves down on the grass, with stomach to the sun.

“After an hour’s rest the call comes to get on our feet again, for time presses and we must resume our climb. Our guide, with the baggage, will proceed alone in a westerly direction, skirting the border of the woods where there is a path practicable for beasts of burden. He will wait for us at the cabin that stands at the upper limit of the beeches, at an altitude of about fifteen hundred and fifty meters. This cabin is a large stone hut and is to serve as our shelter for the coming night, accommodating both men and beasts. Our guide having gone on his way, the rest of us are to continue our ascent until we reach the ridge, which we are then to follow in order to attain the tiptop of the mountain with the least difficulty. From the summit we are to descend after sunset to the stone hut, where the guide will be waiting for us. Such is the plan proposed and adopted.

“The ridge is reached. Toward the south extend the less precipitous slopes that we have just climbed, while to the northward the scene presents a pic-

ture of wild grandeur: the mountain, at one part vertical in outline, at another broken up into terraces of frightful steepness, is almost one tremendous precipice a kilometer and a half in height. A stone thrown from our position finds no stopping-place in its successive rebounds downward until it reaches the valley below, where the eye can just make out the bed of the Toulourenc, which looks like a narrow ribbon at this distance.

“While my companions amuse themselves by overturning masses of rock and sending them crashing down the mountain in a series of terrific concussions, I discover beneath a large flat stone an old insect acquaintance of mine, the bristly *am-mophila*, which hitherto I have always found in solitary isolation along the banks of the highway in the plain below, whereas here, almost at the summit of Mt. Ventoux, I find this wasp in groups of several hundreds each, under a common shelter.

“I am trying to learn the reason of this close huddling together when the south wind, which has already this morning given us some little anxiety, suddenly brings with it a train of clouds that proceed to drench us with rain. Almost before we are aware of it we are enveloped in a thick drizzly mist so dense that we cannot see two steps ahead. By an annoying coincidence one of our party, my excellent friend Thomas Delacour, has gone off by himself in search of the *euphorbia saxatilis*, one of the botanical curiosities of these high altitudes. Making a trumpet with our two hands, we send forth a united call with all the strength of our lungs.

No response. Indeed, our shout is lost in the fleecy mass of fog around us and in the rushing sound of the whirling clouds. We are forced therefore to make a hunt for the stray member of our band, since he cannot hear our call.

“In the obscurity of the enveloping mist we cannot see one another at a distance of two or three paces, and I am the only one of the seven to possess any acquaintance with the region. To prevent the loss of any one else out of our party we join hands, and I lead the line. For a while we find ourselves engaged in a veritable game of blind-man’s-buff, and we accomplish nothing. Undoubtedly Delacour, who knows the mountain well, has taken warning at the gathering of the clouds and has profited by the last lingering daylight to proceed in all haste to the shelter of the stone hut. Let us follow his example, and that without delay, for already the rain-water is trickling down the inside of our garments as well as the outside. Our underclothes cling to our bodies like a second skin.

“A serious difficulty arises at this point: in going back and forth and round and round in search of my friend I have put myself in the position of a person whose eyes have been bandaged and who has been spun around on his toes. I have lost my bearings and am quite unable to determine which way is south. I question first one and then another of my companions, but they answer doubtfully and with no sort of agreement. The truth of it is, we none of us know our points of the compass. Never in all my life have I appreciated the value of those

points as I did at that moment. All about us extends the baffling gray fog, while under our feet we can feel, surely enough, the sloping away of the ground, here in one direction and there in the opposite direction; but which slope is it that is the right one for us? We must make our choice and then go forward unhesitatingly. If by mischance we descend the northern slope, we shall break our necks in falling down one of the precipices that a little while before looked so frightful to us. Perhaps not a soul would survive to tell the tale. For some minutes I experience nothing but the most agonizing perplexity.

“It is the opinion of the majority that we had best stay where we are; but the others think this would be very unwise, and I agree with them. I point out to the party that the rain may continue a long time, and in our drenched condition we are in danger of freezing where we stand when the cold night shuts down upon us. My worthy friend Bernard Verlot, who has come from the Botanical Garden of Paris for the express purpose of climbing Mt. Ventoux with me, maintains an imperturbable calm, trusting entirely to my prudence to extricate us from our critical situation. I draw him a little aside, in order not to add anything to the alarm of the others, and reveal to him my very grave apprehensions. We hold a council of war, we two, and endeavor to supply the place of the lacking magnetic needle with the compass of reflection.

“ ‘When the clouds first gathered,’ I say to him, ‘they came from the south, did they not?’ ”

“ ‘Yes, unquestionably, from the south.’

“ ‘And although there was hardly any wind perceptible, the rain came slightly slanting from the south toward the north?’

“ ‘Certainly. I took note of that direction, so far as it was possible to do so. Haven’t we there something to serve us as guide? Let us go in the direction from which the rain comes.’

“ ‘I had thought of that,’ I reply, ‘but I have some doubts. The wind is too slight to have any well-defined direction. It may be a shifting wind such as often prevails at the summit when clouds gather there. We have no assurance that the original direction of the wind has continued and that whatever breeze there is may not now come from the north.’

“ ‘Yes, I quite agree with you. What, then, is to be done?’

“ ‘There’s the difficulty. But I have an idea: if the wind has not shifted we ought all of us to be wetter on the left side than on the right, the rain having come from that direction as long as we could make out our bearings. If it has shifted we ought to be about as wet on one side as on the other. Let us all feel of ourselves and decide the question. Isn’t that the best plan?’

“ ‘Assuredly.’

“ ‘But what if I am mistaken?’

“ ‘You are not mistaken.’

“ ‘In a few words our companions are informed of the result of our deliberations. Every man feels of himself, not of his outer clothing merely, which

would have been an insufficient test, but under the very undermost of his wearing apparel, and it is with inexpressible relief that I hear the left side unanimously declared to be wetter than the right. The wind, then, has not shifted. Good! Let us proceed in the direction whence the rain comes. The line is reformed, with me at the head and Verlot as rear guard to make sure no one is dropped on the way. But before starting I ask my friend once more:

“ ‘Shall we risk it?’ ”

“ ‘Yes, we ’ll risk it. Go ahead. I ’ll follow.’ ”

“And so we push forward blindly into the formidable unknown. But we have not gone twenty steps, twenty of those steps that one cannot very well control where the descent is steep, before all fear of danger is dispelled. Under our feet we feel, not the void of a frightful abyss, but the firm ground so ardently desired, the ground strewn with little stones that go rolling and rattling downward as we tread them. In our ears this rattling, this indication of safe foothold for us, is divine music. A few minutes suffice to bring us to the upper fringe of the beeches. Here the darkness is deeper than on the mountain-top, and we are obliged to stoop to see where to put our feet.

“How, in this very dim light, are we to find the stone hut, buried as it is in the heart of the woods? Two plants, persistent frequenters of the haunts of man, serve us as guides. They are the stinging nettle and the pigweed. With my disengaged hand I grope all about me as I advance, and every time I

encounter prickles I know I have touched a nettle, a sign-post along our way. Verlot in the rear also thrashes about in valiant fashion, making a sharply pricked finger do duty for eyesight. The rest of our company have little faith in this mode of pathfinding. They propose that we shall continue at top speed down the mountain to our starting-point at Bédoin. But Verlot has far more confidence than they in the botanical instinct, with which he on his part is so richly endowed, and he joins with me in urging a continuance of our present method of groping our way. He reassures the more demoralized of our number and demonstrates to them the entire feasibility of reaching our proposed shelter, despite the darkness, by feeling of the plants along the route with an inquiring hand. Finally they yield to our persuasions and a little later, by groping our way from nettle to nettle, we arrive at the stone hut.

“Delacour is already there, as well as the guide with our baggage, which was placed under cover before the rain set in. A blazing fire and a change of clothing soon restore our habitual high spirits. A block of hardened snow from the neighboring ravine is hung in a sack before the fire, and a bottle is placed to receive the water as the melting proceeds; and so we are provided with a well-spring for the requirements of our evening meal.

“When supper has been eaten we dispose ourselves for the night on a bed of beech-leaves that have been pretty thoroughly ground to powder by those that have slept there before us, and they must have been many; for who can tell the number of

years that have passed since this mattress, now little better than a dust-heap, was renewed? Those who cannot sleep are commissioned to keep up the fire, and there is no lack of hands for this duty, as the smoke, having no other issue than a large hole caused by the partial falling in of the roof, fills the hut with a smudge fit for smoking herrings. To get a mouthful or two of breathable air one has to lie with face close to the ground in the very lowest layer of the room's atmosphere. Coughing, cursing, and fire-tending go on through the night; but as for sleeping, that is out of the question. At two o'clock in the morning we are all up and ready for our climb to the summit, where we are to witness the sunrise. The rain has ceased, the sky is beautifully clear, and there is every promise of a fine day.

“During the ascent some of the party experience a sort of heart-failure caused primarily by fatigue and in the second place by the rarefaction of the atmosphere. The barometer has gone down one hundred and forty millimeters, which means that the air we breathe is one fifth less dense than the normal and hence by so much poorer in oxygen. To a person in good physical condition this slight change in the atmosphere would be imperceptible, but when added to the fatigue of our preceding day's exertions and to our loss of sleep it aggravates our discomfort. Consequently it is at a slow pace that we push our way upward, dragging weary legs and panting for breath. Every twenty steps there are more than one of the party forced to halt. But at last we reach the summit and take refuge

in the rustic chapel of Saint-Croix to recover our breath and to combat the piercing cold of the early morning with a draft of wine, of which we do not stint ourselves.

“Presently the sun begins to peep above the eastern horizon. In the west, as far as the eye can see, the mountain throws its triangular shadow, its outlines iridescent with violet hues from the diffraction of the sun’s rays. Toward the south and west stretches the gloom-enshrouded plain where, when the sun is higher, we shall be able to distinguish the Rhone like a thread of silver. To the north and east there is spread out at our feet a vast bed of clouds, a sort of ocean of white cotton-wool, out of which emerge, like islets of slag, the faintly discerned summits of the lower mountains. In the far distance, where the Alps lift their giant masses, peaks are visible here and there gleaming with their thread-like lines of glaciers.”

But the call of the plant world was insistent. Fabre and his botanist friends turned from the wonders and the splendors of this mountain scenery to hunt for flowers and to gather such specimens as, by reason of their rarity, were worth carrying home. Incidentally our entomologist had already made an interesting and at first very puzzling discovery. Under a flat stone he had, the day before, found a swarm of digger-wasps, apparently taking refuge from the rising storm. But what was this warmth-loving and usually solitary insect doing near the top of Mt. Ventoux, and in such numbers? It was like finding, for example, hundreds of cabbage-

butterflies fluttering about the summit of Mt. Washington. The thing was almost unprecedented in the annals of entomology. However, a little reflection brought the probable solution of the problem. The time of year was August, or near the season when certain European birds begin their flight southward for the winter. Might it not be that this company of wasps, impelled by instinct to seek a warmer region for their winter quarters, were emigrating from a colder to a warmer district when, in flying over Mt. Ventoux, they were caught in the rain and descended to take shelter under a stone until the storm should have passed? Such extensive migration on the part of wasps was a novelty to the observer, it is true, but by no means an impossible explanation of the mystery, especially when taken in connection with a previous discovery on very nearly the same spot. In an earlier ascent of the mountain Fabre had, to his astonishment, found the little chapel at the summit completely covered with ladybugs. What were these "insects of the good God" doing so far away from the vegetation that commonly attracts them? Nothing in the way of food suitable to their needs was to be found at that lofty height. The only explanation was that they were on their way southward and had stopped to rest in their long passage over the mountain.

Incidents like this mountain-climbing expedition help us to see and to know our naturalist as he actually was in his daily walks and talks and meditations. He had an alert and far-ranging intelligence; he was interested in many things, well in-

formed in numerous branches of knowledge, and skilled in more than a few handicrafts; in short, nothing human was alien to him, and hence it is that we find ourselves so strongly drawn to him.

CHAPTER XI

A VISIT FROM PASTEUR

FABRE opens one of the chapters of his "Souvenirs" with the remark that "book-learning is of comparatively little value in solving the problems of life; here the richest library is inferior to a direct intercourse with the facts. Very often, indeed, it is of advantage to be entirely without book-learning, as the mind then retains its freedom of inquiry and does not get lost in paths that lead nowhither, paths suggested by mere reading." Then he tells how a learned work by an expert once nearly misled him in his study of the scorpion. The book said that the scorpion of Languedoc produces its family in September, whereas this interesting event falls much earlier, and had not Fabre suspected inaccuracy here, he would have lost a whole year in the particular research then engaging him. In the end he might, owing to the press of other matters, have been forced to abandon his study of an extremely interesting member of the animal kingdom, and we might not have had from his pen the highly readable and instructive chapter that now forms a part of his published reminiscences.

"Yes," he repeats, "ignorance has its advan-

tages. Far from the beaten tracks one meets with the new and the unexpected. One of our most illustrious masters taught me this long ago, without suspecting that he was giving me a most valuable lesson. Without warning there came one day to my door and rang my bell no less a personage than Pasteur, the man who was soon to achieve such celebrity."

Pasteur was almost exactly one year older than Fabre. He was already famous and soon to be far more so. His country was eventually to declare him, by popular vote, to be "the greatest Frenchman of all time." But this came much later. Fabre mentions some of Pasteur's earlier contributions to science, and then continues:

"Every age has its scientific fad: to-day it is evolution, before that it was spontaneous generation. Pasteur, with his glass flasks containing sterilized or unsterilized matter at his option, and by a series of simple experiments conducted with the utmost care, silenced for all time the crazy assertion that chemical action set up in a decaying substance can produce life.

"It was at the height of this controversy, and while Pasteur was triumphantly proving his point, that I accorded the handsomest reception in my power to this illustrious visitor of mine. The distinguished scientist had sought me out, in preference to any other, for the purpose of obtaining certain information. I owed this high honor to my position as his fellow-worker in physics and chemistry. But what an obscure and humble fellow-

worker! My guest's mission to Avignon and its neighborhood had to do with silk-culture. For some years the silkworm nurseries had been in a lamentable condition, ravaged by an unknown scourge. From no apparent cause the worms would either mortify and turn to putrid liquid matter, or they would harden and become as brittle as a nutshell. In dire dismay the peasant of southern France saw one of his chief sources of income suddenly closed to him; after much care and expense he was obliged to throw his stock in trade on the dungheap.

"After a few words between my visitor and myself on the silkworm distemper, he made a request.

" 'I should like,' said he, 'to see some cocoons. I have never seen any. I know them only by name. Could you get me some?'

" 'Nothing easier,' I replied. 'My landlord deals in cocoons, and he lives next door. Have the goodness to wait a moment and I will fetch what you desire.'

"A few steps took me to my neighbor's house, where I filled my pockets with cocoons. Then I hastened back and presented them to the man of science. He took up one and turned it over and over in his hand, examining it curiously, as we should examine a foreign object from the ends of the earth. Finally he held it up to his ear and shook it.

" 'It rattles,' said he in great surprise. 'There's something inside.'

" 'Certainly,' I replied.

" 'But what is it?'

" 'The chrysalis.'

“ ‘What do you mean—the chrysalis?’

“ ‘I mean the sort of mummy into which the worm changes before turning into a butterfly.’

“ ‘And is there one of these things in every cocoon?’

“ ‘To be sure there is, for it is in order to protect the chrysalis that the silkworm spins the cocoon.’

“ ‘Ah!’

“ ‘And therewith the cocoons were pocketed by the scientist, that he might later and at leisure study this interesting novelty, the chrysalis. Such magnificent assurance greatly impressed me. Utterly ignorant of silkworms, cocoon, chrysalis, and the final metamorphosis of the insect, Pasteur had come among us to set the silkworm industry on its feet again. The gymnasts of antiquity offered themselves naked to the combat. Pasteur also, inspired combatant against the silkworm scourge, rushed into the fray unprepared and unarmed—that is, without knowing the first thing about the insect he proposed to rescue from peril. I was astonished; nay, more, I was stupefied.’”

Nevertheless the end in view was attained: the silk-culture of southern France was saved from destruction by the great bacteriologist. Coming to matters of more intimate personal concern, Fabre continues:

“ ‘I was less astounded by what followed. Another topic was at that time engaging Pasteur’s attention, namely, the question of improving the quality of wine by heating. Abruptly changing the subject, he said:

“ ‘Show me your wine-cellar.’

“ ‘Show him my wine-cellar! A request of that sort to me, a poor professor whose pitiful stipend did not allow him to spend a sou on wine! I had to content myself with a sort of piquette that I made by putting a handful of brown sugar and some apple pulp into a jar and letting the mixture ferment. My wine-cellar, indeed! Why not my hogsheads and my dusty bottles labeled with the special brand and the year of the vintage?

“ ‘Greatly embarrassed, I evaded the request and tried to change the subject, but he was persistent.

“ ‘Show me your wine-cellar, I beg of you.’

“ ‘There was nothing for it but to yield. I pointed with my finger to a corner of the kitchen where there stood a disabled chair and, on the chair, a demijohn holding a dozen liters.

“ ‘There, sir, is my wine-cellar.’

“ ‘Your wine-cellar, that?’

“ ‘I have no other.’

“ ‘Then that is all you have in the way of a wine-cellar?’

“ ‘Alas, yes! that is all.’

“ ‘Ah!’

“ ‘Nothing further on that topic from the man of science. Evidently Pasteur was a stranger to this strongly spiced beverage vulgarly known as ‘mad cow.’ If my wine-cellar, the old chair with the empty demijohn, was silent on the subject of ferments to be counteracted by heat, it spoke eloquently of something else that my illustrious visitor did not appear to understand. There was one microbe

that had escaped his observation, and it was one of the most terrible, that of misfortune strangling good-will.

“But despite the embarrassing reference to my wine-cellar I was deeply impressed with my visitor’s serene self-confidence. He knew nothing whatever about the transformation of insects; he saw a cocoon for the first time, and learned that it contained something that might be regarded as the first rough outline of the future butterfly; he did not know what the merest country child of our southern districts knows well enough; and this novice, whose ingenuous questions caused me so much surprise, was on the point of revolutionizing the hygiene of silk-culture. He was also about to revolutionize medicine and hygiene in general.

“His weapon was the heaven-inspired idea, careless of details and viewing things in their larger aspect. Of what concern to him were larva, cocoon, nymph, pupa, chrysalis, metamorphosis, and the thousand and one little secrets of entomology? In the problems that he deals with it may even be an advantage to remain ignorant of all these matters. Freed from the fetters of the known, ideas can better preserve their independence and their boldness of flight; their movements will have greater spontaneity.

“Encouraged by the splendid example of Pasteur holding the cocoon to his ear and shaking it, I have made it a rule to follow the method of ignorance in my study of instinct. I read very little. Instead of turning over a lot of books, which is an expensive

process and not within my means, and instead of consulting other scholars, I plant myself squarely and determinedly in front of my subject and stay there until I succeed in making it speak. I am ignorant. So much the better, for my inquiries will have the more freedom, being turned in one direction to-day and in quite the opposite direction to-morrow, according to the glimmerings of light that I receive. If by chance I open a book, I am careful to leave a large compartment in my mind for doubts, so abundantly do weeds and brambles flourish in the soil that I am cultivating.”

It is significant that the library of this unbookish scientist and writer was contained—is now contained, in fact, in the old house at Sérignan preserved as a memorial and a museum—in a single bookcase of a few shelves. Nevertheless one cannot read Fabre without perceiving that he was not unacquainted with literature. Apt allusions and quotations, especially from the classics, occur with some frequency in his pages. There are many ways of using books. Some men get more out of them by rapidly turning the leaves than do others by the most conscientious reading. We suspect that Fabre belonged to the former class. At any rate, he had a wonderful memory, and his treasures of knowledge, however acquired, were always easily at his command.

CHAPTER XII

ANOTHER MEMORABLE VISIT

A CALLER who showed himself less indifferent than Pasteur to Fabre's slenderness of means was the historian Duruy, who served as Minister of Public Instruction under Napoleon III from 1863 to 1869. It was in this latter capacity that he visited the academy at Avignon where Fabre was teaching physics and chemistry. The particulars of his visit may best be given in Fabre's own words. But first he tells of an earlier glimpse he had of the man:

"Our school used to be visited by inspectors-general. These gentlemen travel in couples, one of the pair giving his attention to literature, the other to science. On the occasion I now refer to, when the inspection was concluded and the official documents had been verified, the teaching staff was summoned to the principal's parlor to listen to the parting words of advice uttered by the two high personages. He of the sciences spoke first. If I were questioned upon what he said, I should be sadly at a loss to recall a word of it. His speech was cold, formal, prosaic—words without soul and forgotten as soon as heard; in short, a penance for both listener and speaker. I had already heard so many of

these chilly homilies that one more could hardly make any impression on my mind.

"Then the inspector in literature spoke in his turn. As soon as he opened his mouth I said to myself, 'Oho! this is quite another sort of thing!'

"His words were full of feeling, they were vibrant, they were chosen with the skill of an artist. Free from learned platitudes, the theme took a lofty flight; it soared serenely in the unclouded heights of a kindly philosophy. This time I found myself listening with pleasure; I even felt myself deeply stirred. It was no official homily, but a spontaneous outpouring, an utterance that fairly carried the hearers away. It was the deliverance of a worthy man skilled in the art of speaking, according to the ancient definition of an orator. Never before in my experience as a teacher had I enjoyed such a treat.

"On coming away at the end with my heart beating faster than was its wont, I said to myself: 'What a pity it is that my department, that of the sciences, cannot some day bring me into closer touch with this inspector! I believe we should become fast friends.' I inquired his name, of my colleagues, who were always better informed than I, and they told me it was Victor Duruy."

Two years passed, and meanwhile Fabre became interested in a new process of his own invention for obtaining dye from madder. This invention he hoped would be the source of the longed-for revenue that should enable him to accept a poorly paid but highly honorable professorship in some great university. Of these experiments with vegetable dyes,

of the high expectations they aroused, and of the inventor's ultimate cruel disappointment, more will be said in a future chapter. In the meantime let us continue with Fabre's own narrative.

"One day a couple of years later," says he, "while I was tending my vats, myself enveloped in steam and my hands looking like boiled lobsters from the indelible red of my dyes, all at once I saw some one come in whose face immediately struck me as familiar. Nor was I deceived: it was indeed the very man, the inspector-general whose speech had, once upon a time, stirred me to the depths. Since then Monsieur Duruy had been appointed Minister of Public Instruction, he was addressed as 'your Excellency,' and this title, ordinarily an empty form, was in his case one of the most highly deserved that has ever been conferred. Our cabinet minister was filling his important office with distinction, and we all held him in the utmost esteem. He belonged to the class of modest and industrious workers.

" 'I should like,' began my visitor, with a genial smile, 'to spend the last quarter of an hour or so of my little stay in Avignon with you alone. It will be a welcome relief after all this ceremonial scraping and bowing.'

"Covered with confusion at finding myself thus honored, I apologized for my shirt-sleeves and still more for my lobster-claws, which I had for a moment tried to hide behind my back.

" 'You need n't apologize,' said he. 'I came to see the worker, and the worker is never seen to better advantage than in his working-costume and with

all the marks of his calling upon him. Let us have a little talk. What are you up to just now?’

“I briefly explained the object of my researches, showing the minister what I had thus far accomplished and making, for his further enlightenment, a trial impression in madder-red on a piece of white fabric. The success of the experiment and the simplicity of my apparatus, in which a shallow dish with its contents kept at the boiling-point under a glass funnel took the place of a steam chamber, caused him some surprise.

“‘I will help you,’ he volunteered. ‘What do you need for your laboratory?’

“‘Why, nothing, your Excellency, nothing. With a little contriving I can make my outfit suffice.’

“‘What! nothing? Then you are a solitary exception to the rule. All the rest overwhelm me with requests; their laboratories are never properly equipped. And you, poor though you are, reject my offers!’

“‘No, there is one thing I will not reject.’

“‘What is that?’

“‘The high honor of shaking hands with you.’

“‘You shall have the hand-shake, my friend, and it shall be of the heartiest sort. But that is not enough. What else do you want?’

“‘The Paris Botanical Garden is in your charge. If a crocodile should die, let me have the skin. I will stuff it with straw and hang it from the vaulted roof here. With this embellishment my workshop will rival the wizard’s den.’ ”

It is to be noted here that the “workshop” in

question was in the ancient abbey of Saint Martial, then no longer devoted to religious uses.

“With a glance around him, at the nave and at the Gothic roof, the minister replied: ‘Yes, that would fit in admirably.’ And he laughed in appreciation of my whimsical suggestion; then, continuing, ‘I now have made the acquaintance of the chemist,’ said he. ‘I already knew the naturalist and the writer. I have heard of your little animals, and I regret that I am obliged to leave without seeing them; but that must be deferred until another occasion. It is about time for my train. Come with me to the station, will you? We shall be alone and we can talk a little more on the way.’

“We walked at a leisurely gait, discussing entomology and madder as we strolled along. My bashfulness had quite left me. The pomposity of an idiot would have shut me up tight; the charming frankness of a lofty soul put me at my ease. I unbosomed myself concerning my natural-history researches, my professorial projects, my struggles with a hard fate, my hopes and my fears. My companion cheered me up—spoke to me of better things ahead. Ah, that delightful saunter along the wide avenue leading to the railway station!

“A poor old woman in rags, her back bent with age and with field labor, met us. Shyly she held out her hand for alms. Duruy felt in his pocket, found a two-franc piece, and placed it in the outstretched palm. I should have liked to do my part and add at least a couple of sous, but my purse was

empty, as usual. So I went up to the beggar-woman and whispered in her ear:

“ ‘Do you know who it is that gave you that? It is the emperor’s minister.’ ”

“The poor woman started, looking in awe from the exalted personage of generous impulses to the silver piece, and from the silver piece to the exalted personage. What a surprise! What a windfall!

“ ‘May the good God give you health and long life!’ her cracked old voice murmured in her country dialect. Then, saluting with an inclination of the head, she went off, her eyes still on the two-franc piece in the hollow of her hand.

“ ‘What did she say?’ asked Duruy.

“I translated the pious benediction and repeated it mentally on my own account. When a man halts so kindly before the outstretched hand of a beggar, it is a sign that his heart has qualities better than those of a mere cabinet minister.

“We entered the station, still alone, as my companion had promised, and I continued my confidences. Ah, if I had but foreseen what was coming, how I should have made haste to take my leave! For, behold, there was a group gradually gathering in a half-circle before us. It was too late to run away. Well, then, let us put on a bold front and make the best of it. There came the general of division and his officers, also the prefect and his secretary, and then the mayor and his deputy, after them the school-inspector, and finally the pick of the teaching-staff. The minister faced the ceremonious

assemblage, with me at his side. It was a crowd of local dignitaries over against us two.

“Then followed the customary inflections of the spine, the empty salutes, that the excellent Duruy had come to my laboratory to get away from for a few minutes. When the faithful pay their reverence to Saint Roch¹ in his niche, they salute at the same time the humble companion of that holy man. I felt rather like the dog of Saint Roch before all this obeisance that had no reference to me. But I stood my ground and looked on, my frightful red hands hidden behind my back and under the broad brim of my felt hat, which I was holding.

“After the official exchange of compliments the conversation was beginning to languish, when the minister took my right hand and gently withdrew it from its place of concealment.

“‘Show your hands to these gentlemen,’ said he. ‘Any one else would be proud of such hands.’

“In vain did I protest and try to disengage my hand; I was forced to comply. I displayed my lobster claws.

“‘The hands of a working man,’ commented the prefect’s secretary, ‘the hands of a veritable working man.’

“Well-nigh scandalized at seeing me in such ex-

¹ Saint Roch, or Rochus (1295—1327), a Franciscan monk, born and died at Montpellier, and canonized for his great piety and his healing ministrations to the plague-stricken. His statues represent him with the dog that saved his life by daily bringing him bread when he lay ill in a forest near Piacenza after tending the sick of that city.

alted company, the general added, 'The hands of a dyer and cleaner.'

" 'Yes, the hands of a working man,' replied the minister, 'and I wish you had many more such. They will, I am glad to believe, render valiant service to the chief industry of your city. Skilled in handling chemical reagents, they handle not less skilfully the pen, the pencil, the magnifying-glass, and the scalpel. As no one here seems to know all this, I am very glad to be able to enlighten you.'

"For one embarrassing moment I wished for nothing so much as that the earth might open and swallow me. But fortunately just then the bell rang, announcing the departure of the train. Bidding the minister good-by, I fled in all haste, leaving him laughing at the trick he had played me.

"The affair was noised abroad, as of course it could not fail to be, the waiting-room of a railway station being no place for keeping secrets, and I had ample time to learn what annoyances a man may be subjected to by the benevolent attentions of the powerful. I was regarded as a person of influence, with the favors of the gods at my disposal, and I was pestered with petitions. This one wished for a license to sell tobacco, that one a scholarship for his son, and still another desired an increase in his pension. They said I had only to ask and my request would be granted.

"Oh, you poor innocents, what a delusion you were laboring under! You could not have hit upon a worse intercessor. To think of me as a suppliant

for favors! I have many failings, I admit, but surely that is not one of them. I shook off these importunate persons as best I could, leaving them greatly puzzled by my unresponsiveness. What would they have said if they had known the minister's offer concerning my laboratory, and my facetious request for a crocodile skin to hang up under the roof? They would have called me an imbecile."

CHAPTER XIII

AT THE EMPEROR'S COURT

NO greater incongruity could be imagined than that of our self-effacing naturalist making his way through the liveried flunkydome of imperial ante-chambers into the august presence of the emperor himself. But it is not the unexpected alone that so often happens in this world of ours; the incongruous also adds its spice of variety to our life. How this piquant interlude came to be staged will best be told by the chief actor in it—for we refuse to regard Louis Napoleon as a more impressive figure than Jean Henri Fabre.

“Six months passed, and I received a letter summoning me to the minister’s office. I suspected a proposal to advance me to a position in a more important institution, and I begged to be allowed to remain where I was, with my vats and my insects. But there came a second letter, more urgent than the first, and this time signed by the minister himself. The letter read thus :

“ ‘Come immediately or I will have my gendarmes fetch you.’ ”

“There was no way out of it. Twenty-four hours later I was in Monsieur Duruy’s office. With exquisite affability he held out his hand to me and, taking up a number of the ‘Moniteur,’ said :

“ ‘Read that. You rejected my offer of equipment for your laboratory; you will not reject this.’

“I looked at the line indicated by his finger and read my name in the Legion of Honor list. Overcome with amazement, I stammered something or other in acknowledgment.

“ ‘Come here,’ said he, ‘and let me give you the accolade. I will be your sponsor. If the ceremony takes place privately between us two, you will be only the more pleased. I know you.’

“He pinned the red ribbon on me, kissed me on both cheeks, and then had a telegram sent to my family, announcing the glorious event. What a morning I had of it, in intimate conversation with this excellent man!

“I know very well that all this decorative bedizement is sheer nonsense, especially when, as too often happens, wire-pulling enters into the affair and turns the honor to dishonor; but from the way this bit of ribbon came to me it is precious. It is a relic, a souvenir, and not a thing to be paraded in public. I keep it with religious care at the bottom of a bureau drawer.”

This last assertion hardly agrees with what we were told in a preceding chapter, in the naturalist’s own words, concerning the benefit he had derived from wearing his Legion of Honor ribbon in his entomological rambles. Perhaps the explanation is that he did at first allow himself the harmless vanity of wearing the red ribbon, but in later life, when these reminiscences of his were written, tucked it away out of sight. It is only with the dimming of

the eyesight through age that we see things in their proper perspective. But let us resume the narrative.

“There lay on the table a package of big books, a set of the reports on the progress of science drawn up in connection with the Universal Exposition just closed, the exposition of 1867.

“‘Those books are for you,’ continued the minister. ‘Take them home with you and look them over at your leisure. They may interest you. You ’ll find something there about your insects. And take this, too, as reimbursement for the expense you have incurred in making the journey. My putting you to all this trouble ought not to be at your cost. If there is anything left over after you have reimbursed yourself, spend it on your laboratory.’

“So saying he handed me a roll of twelve hundred francs. In vain did I refuse, in vain did I protest that my journey had not been so costly as all that; and, besides, his accolade and the decoration were worth inestimably more than the sum total of my traveling expenses. He was insistent.

“‘Take it, I tell you,’ he commanded, ‘or I shall fly into a passion. And that is n’t all, either. Tomorrow you will go with me to the Emperor’s palace, to the reception he is to give to the learned societies.’

“Seeing me bewildered and completely upset at the prospect of an imperial interview, he went on:

“‘Don’t you dare give me the slip! If you do, look out for the gendarmes I wrote you about in

my letter. You saw some of these fellows, my men in bear-skin head-gear, as you came in. Don't fall into their hands. But to shield you from all temptation to run away, we will go to the Tuileries together in my carriage.'

"The thing came off as he had planned it. In the morning, accompanied by the minister, I was admitted into a little anteroom at the Tuileries by chamberlains in knee-breeches and silver-buckled shoes. They were queer specimens: their costume and their stiff bearing made them look to me like big beetles with wing-cases in the form of coffee-colored frock-coats adorned with key-shaped embroideries on the back. In the same room there were already waiting a score of persons of various sorts—explorers, geologists, botanists, archivists, archæologists, collectors of prehistoric flints; in short, all the different kinds that go to make up a gathering of provincial scientists.

"The Emperor entered, in simple attire and with no attempt at regal adornment beyond a broad red ribbon of watered silk worn diagonally across the chest. Nothing of majesty about him. He was just a man like the rest of us, rather stout, with a big mustache, and with half-closed eyelids that appeared heavy with drowsiness. He went from one to another of us, chatting a moment with each after the minister had told him our names and what we were engaged in. He showed himself fairly well informed as he passed in conversation from the ice-fields of Spitzbergen to the dunes of Gascony, from a Carolingian charter to the flora of Sahara,

from the progress in beet-culture to Cæsar's trenches before Alesia. When my turn came he questioned me on the hypermetamorphosis of the *meloidæ*, on which I had just written an article. I answered his inquiries, floundering a little in the mode of address and mixing up the every-day 'Monsieur' with the more deferential 'Sire,' a word so strange to my tongue."

The learned treatise mentioned above may call for a word of explanation. In his study of insects Fabre had noticed with much interest that certain parasites pass through several transformations, sometimes no fewer than six, between the egg and the perfect insect. The *meloidæ*, or oil-beetles, are of this kind. The unusual number of changes in the course of the insect's development is denoted by the word "hypermetamorphosis." Perhaps a more easily understood term would have been "super-transformation." Those who are interested in the subject, and in Fabre's detailed account of his investigations in this rather unfamiliar field, are referred to his "Souvenirs."

"I passed through the formidable ordeal somehow," he is thankful to record, "and others succeeded me. This five-minute interview with royalty is accounted a signal honor. I do not dispute it, but I have no desire to repeat the experience. At last the ceremony came to an end, salutations were exchanged, and we took our leave.

"A lunch awaited us at the minister's house. I was placed at his right, much embarrassed at being thus honored, and on his left sat a physiologist of

great renown. Like all the rest I talked a little on all sorts of subjects, even including the old bridge at Avignon. Duruy's son, who sat opposite me, bantered me in friendly fashion on the subject of the famous bridge on which everybody dances, and smiled at my impatience to get back to the thyme-scented hills and the gray-green grasshopper-haunted olive-trees."

The allusion to the famous old bridge of Avignon was better understood in that company of Frenchmen than it would have been in a company of any other nationality, for it called to mind the familiar couplet, which is so simple as hardly to require translation here:

*Sur le pont d'Avignon,
Tout le monde y danse en rond.*

Fabre's manifest reluctance to prolong his stay in Paris had not escaped his host.

"What!" he exclaimed, "are n't you going to visit our museums, our collections? You would find some things well worth seeing."

"I know it, your Excellency," was the reply, "but I shall find still better things, and more to my liking, down there where I came from, in the incomparable museum of the open fields."

"Then what are your plans?"

"I am planning to go home to-morrow."

And he did in fact return to Avignon the next day. "I had had enough of Paris," he declares. "Never had I been so miserably lonesome as in that vast

maelstrom of humanity. To get out of it and away—that was my one longing.

“On returning to my family, what a weight I felt lifted from my breast, and what a celebration we had! In the back of my mind there was a chime of bells ringing out the glad tidings of my approaching escape from slavery. Gradually my dream of perfecting the manufacture of vegetable dyes was nearing realization, and it was full of promise for my liberation from bondage. Yes, I was on the point of achieving the modest competence that would crown my ambitions by enabling me, as the occupant of a university chair, to teach zoölogy and botany.”

CHAPTER XIV

DOUBLE DISASTER

THE art of dyeing by the use of coloring-matter found ready to hand in nature is older than civilization; but the production of dyes from mineral substances by chemical processes is not yet a hundred years old. Until about the middle of the nineteenth century improvements in dyeing had chiefly to do with the preparation and application of natural coloring-substances, such as those obtained from the indigo plant, from henna, litmus, madder, brazil-wood, and so on. The versatile naturalist whose life we are following became interested while he was at Avignon in perfecting the processes by which madder was made to yield a red coloring-matter then in wide use. We have seen him showing Duruy something of the results of his experiments in the laboratory he was allowed to use in the abandoned abbey of Saint Martial.

Up to that time dyeing had not been the simple process it has since become. It had been necessary to apply, besides the coloring-matter, a mordant, or fixing-agent, to insure permanence. A handier method had long been desired, and Fabré, driven by the hard necessity of a nearly empty purse, undertook to meet the demand. Inspector-General Rol-

lier had convinced him that he could not possibly accept a university professorship without some private means of his own to supplement the meager salary then paid to university professors, as to teachers generally, in France. Fabre says:

“And now what means was I to adopt in order to extricate myself from the dilemma pointed out to me by the inspector and verified by my own past experience? I decided upon industrial chemistry as the likeliest way out. The public lectures I was giving in the old abbey of Saint Martial placed at my disposal a spacious and fairly well-equipped laboratory. Why not make use of it?

“The principal industry of Avignon was the production of a dyestuff from madder. The plant was furnished by the agricultural districts to the dye-works, where it was made to yield the purer and more concentrated ingredient required by the dyer. My predecessor at the academy had engaged in this industry and had done well at it, I was told. Let me then, said I, follow in his footsteps and turn to profitable account the vats and furnaces and other costly appliances that I have inherited. So now, let us get to work!

“What was the product that I was in search of? I proposed to extract the coloring-agent, the alizarin, freeing it from the encumbering ingredients that accompany it in the madder-root, and so obtaining it in a pure state and in a form that would make possible its direct impression upon the fabric waiting to receive it. This would be a far more

artistic and rapid process than the old one so long in use.

“Nothing could be simpler than this problem when once it was solved, but how baffling when the solution was still to be found! I dare not recall the amount of imagination and of patience that I expended in endless experimental attempts, in which I tried every possible means, even the most absurd, to attain my purpose. What hours of deep thought in the somber church, what roseate dreams and, a moment later, what black disappointment when practical test said the last word and shattered in a twinkling the airy structure of my visions! With the grim determination of the ancient slave hoarding up his pennies for his final ransom, I reacted to the failure of one day by renewed attempts on the following, often faulty enough in my procedure, as we all are at times, but now and then cheered by the consciousness of making headway. And so I kept everlastingly at it, for I too cherished the inextinguishable hope of winning my freedom.

“Was I destined to succeed? There was a good chance of it, I thought. And at last I seemed to get a satisfactory answer to the query, for I hit upon a practical and inexpensive method of obtaining the coloring-matter I was after, pure, concentrated, and excellent for printing upon fabrics as well as for dyeing them by immersion. One of my friends began to manufacture the dye, by my process, on a large scale in his factory, and a number of calico-manufacturers bought the output and expressed themselves as delighted with it. Fortune

was at last smiling upon me; in my gray sky a hole had opened and roseate beams of light were shining through. I seemed about to acquire the modest fortune without which I should be obliged to deny myself the pleasure of accepting a university chair. Relieved of the accursed anxiety of not knowing one day whether bread for the following would be forthcoming, I could live in peace among my little creatures of the field and forest."

Hardly less than tragic was the blasting of these bright hopes, the bringing to naught of those hours of patient experimenting in that rude laboratory under the Gothic roof. Alizarin, the red coloring-matter obtained originally from the madder-root, was discovered in 1826 by two French chemists, Robiquet and Colin. Fabre's improved process of obtaining it from the same source was highly creditable to his skill and inventiveness in a field of research rather apart from his favorite studies and chief interests. Poetic justice, if not divine justice, would seem to have been violated in his failure to profit by his invention. Curiously enough, the cloud that was to dim his hopes and finally obscure them completely came out of Germany, as other clouds, before and since, have risen from that quarter, to the dismay of more than one Frenchman. Two German chemists, Graebe and Liebermann, discovered in 1868 a process for transforming anthracene, a product of coal-tar, into alizarin, this being the first instance in which chemistry had succeeded in producing one of the old and familiar colors used in dyeing. Not long afterward the process became

available for practical use, and as it was cheaper than the earlier method it soon drove the older dye-stuff made from madder out of the market.

"It was not to be," Fabre tells us resignedly. "I was not to acquire the means to purchase my freedom. I seemed destined to drag the prisoner's ball and chain to the very end. My chime of bells had rung false. Hardly was our factory in full operation when a report began to go the rounds—a vague rumor at first, an echo of probabilities rather than of certainties, but finally a positive assertion that left no room for doubt. Chemistry had obtained artificially the coloring-substance found in the root of madder; a laboratory product was to bring ruin to the agriculture of my region. As to its nullifying all my labors and my hopes, that did not surprise me over much. Having myself puzzled over the problem of artificial alizarin, I knew enough about it to foresee, in the not distant future, the product of the chemist's retort displacing that of our fields and meadows.

"Well, it was all over. The blasting of my hopes was complete. What was I to turn to next? I had to seek a new lever and once more resume the rolling of my Sisyphus-stone up the steep hill. This time I decided to obtain from my ink-bottle, if possible, what my madder vat had refused me."

But before any revenue from that source should begin to come in he was destined to see still lower depths of poverty than any yet reached by him. The man of varied and profound learning who, there is reason to believe, had been selected

by the French Emperor's minister Duruy for recommendation as an instructor well qualified to superintend the education of the Prince Imperial was to be forced out of his modest position in the Avignon academy and left to shift for himself. Without doubt Duruy had perceived, when Fabre visited him in Paris, how distasteful to him would be a life in the frivolous French capital and attendance upon a royal personage. At any rate, the absurdly incongruous offer seems never to have been made; and so from the friendship and favor of the genial minister he got nothing in the way of professional advancement, as indeed he had desired nothing.

Of the successive changes of position and of residence in his earlier life, Fabre writes:

“The first of these removals”—by this he means removals other than those brought about by voluntary resignation—“was in 1870. A short time before that date a minister who has left behind him memories of so enduring a kind in the university, the excellent Monsieur Victor Duruy, had instituted courses for the higher education of girls. This was the beginning, so far as was then possible, of that momentous agitation which is still going on to-day. Very willingly I tendered my humble services in this work of enlightenment, and to me was assigned the giving of instruction in the natural and physical sciences. I had faith in the cause and freely gave myself to its furtherance, with the result that I have rarely faced more attentive or more keenly interested audiences. The days appointed for my lectures were festive occasions, espe-

cially when botany was our theme; then the table would be buried under the floral treasures from neighboring green-houses.

"But I was guilty of overstepping the limits. You shall judge for yourselves, my readers, how black was my crime. I was actually teaching these young women what air is, and water; whence the lightning-flash and the thunderbolt come; by what contrivance thought is sent across continents and under oceans along a metal wire; why fire burns and man breathes; and how a seed sprouts and a blossom opens—all of which was in the highest degree abominable in the opinion of certain persons whose eyes are too weak to bear the unclouded light of day.

"The little lamp must be extinguished without delay, and the shameless offender who tried to keep it alight must be got rid of. How this should be effected was craftily planned with the aid of my landladies, old maids who saw in these educational innovations nothing but the abomination of desolation. I had no lease to protect me. The bailiff appeared with his legal document informing me bluntly that I was required to vacate the premises within four weeks from date; otherwise the law would throw my household goods out into the street. I had to find shelter elsewhere, and with little enough time in which to look around. By chance the first house that I found available was one in Orange. In such wise was my departure from Avignon brought about."

But it was not only bigoted old maids that showed

themselves hostile to the shameless corrupter of virgin innocence; his own associates and fellow-workers in the academy viewed with jealousy and suspicion the growing popularity of this self-taught upstart from the ranks of the peasantry. One who obstinately refused to bend the knee to the idols of the hour, who openly scorned the artificialities of polite society, who seemed to take a perverse delight in straying from the beaten track leading to professional advancement—the track that his betters before him had obediently and decorously followed—surely such a one was not to be tolerated. Can anything equal the arrogant intolerance of established usage, the ruthless compulsion of vested interests? Well, Fabre was not one to be compelled, not one to be frightened into conformity; and so he had to take the consequences, which in the end turned out to be inestimably to his advantage and to the profit of his many readers and admirers.

In the meanwhile, however, it was a rough road he had to travel, and without the timely and generous assistance of one loyal friend it seems as if he must have succumbed to the crushing burden of ill that he was forced to bear. It had so happened, a few years before, that the curatorship of the Requien Museum, a natural-history collection housed in the ancient abbey that also sheltered Fabre's chemical laboratory, fell vacant and the young instructor recently come from Corsica applied for the post and obtained it. There could not have been any eager demand for this obscure and unremunerative position, else our modest applicant would prob-

ably have been passed over in favor of some more clamorous candidate. But as the affair fortunately shaped itself it was here, in the old abbey, among his retorts and test-tubes, that Fabre was one day visited by a stranger from England who had come to the abbey to see the museum of which Fabre was the custodian.

The stranger was John Stuart Mill, destined like Fabre to subsequent fame, and also, unlike him at that time, already enjoying a measure of renown and some worldly prosperity. Both men were eager seekers after knowledge in all departments of science, and each recognized in the other, beneath the considerable differences of temperament and tastes, a kindred spirit. It was botany that served as the immediate bond of common interest between the two: together they roamed the fields about Avignon, collecting specimens and enjoying a sympathetic communion that was of necessity mostly silent, differences of language being added to those other differences that put some constraint, of no unfriendly sort, upon their freedom of intercourse. In the first place, Mill was older by sixteen years and seven months than his fellow-botanist. Moreover, he had, a short time before this, been elected a member of Parliament. Could one think of any vocation more uncongenial to the historian of the insects than politics? Nevertheless the two got on admirably together, and when the blow, the double blow, came that so nearly prostrated the Avignon teacher and industrial chemist, it was Mill who came

to the rescue. On learning from his friend how badly things were going with him, he promptly and generously sent him (from England, where Mill then was) nearly three thousand francs. Thus furnished, the dispossessed tenant of the heartless and narrow-minded old maids was able to remove his family and his household possessions to a less unfriendly shelter at Orange, about twelve miles distant.

At this point the query may have arisen in the reader's mind, why did not Fabre's powerful friend, the minister of public instruction, take steps either to prevent the injustice inflicted upon him or, if this was impossible, to make that injury good by an appointment elsewhere? It was for coming to Duruy's aid in the cause of female education that Fabre suffered, and surely he deserved some active support, in his hour of trial, from the one who, indirectly, was the cause of his misfortune. The explanation is simple enough: Duruy had in 1869 been forced out of office by the "Clericals," the political party opposed to his own, and consequently was no longer in a position to shield his unfortunate friend in the south of France.

That "there is some soul of goodness in things evil" the remaining chapters of this biography will help us to believe. When it seemed to Fabre that the bottom was dropping out of everything and the future looked blank and hopeless, he was in reality just finding his feet, just entering upon the path that was to bring him into his own and lead him on-

ward through many years of calm content amid the scenes and interests and activities that were best calculated to keep him happy, or in such happiness as is vouchsafed to man, who "is born unto trouble as the sparks fly upward."

CHAPTER XV

FABRE AT ORANGE

IT was in 1870, after seventeen busy and fruitful though not untroubled years at Avignon, that Fabre ceased to be the formal instructor of a limited number of pupils and became the teacher and entertainer of a wider and ever wider public, which he reached through the written and not the spoken word. On his retirement to Orange he was obliged to find some new means of supporting his family. There were five children, three girls and two boys—Antonia, Aglaé, Claire, Jules, and Emile. A second marriage in what with most men would be reckoned as the decline of life was to bring him three more—Paul, Anna, and Marie-Pauline, “the joy of my old age,” he called them. But his present family was enough to keep the father busy in providing its members with food and clothing and the other necessities of life.

At Orange Fabre’s admirable series of handy volumes on elementary science was begun. Their author had long felt that school text-books were needlessly stiff and formal and uninteresting. Why, he asked himself, should not young readers be entertained and instructed at the same time, by having their curiosity aroused and their natural eagerness to know more about the world around them grati-

fied? Accordingly he proceeded to tell them "stories," as he called his simple and vivid sketches, about plants and animals, the sun and the planets, the air we breathe, the food we eat, the water we drink, and the clothes we wear, with much else besides. A half-dozen or more attractively written "story-books" are now giving pleasure and at the same time instruction to thousands of English-speaking young readers, as they have for decades been furnishing the boys and girls of France with wholesome and interesting as well as instructive reading-matter. One of the best features of these books is that in them the author does not "write down" to the level, or rather the supposed level, of his young readers. He talks to them as he doubtless talked orally to his own wide-awake and intelligent children, and he does not hesitate to use a long word or even a learned word where that is the best word for his purpose. But for all that he is very sure to make his meaning plain even to the youngest of his readers. Flashes of wit, gleams of humor, even touches of irony and strokes of satire are not excluded from these little manuals; and that is one reason why older readers also like to turn their pages. It was, we are told, because Duruy found himself so impressed with the clear and in every way admirable style of Fabre the writer of school text-books that he conceived the idea of establishing him at the Tuileries as tutor to the Prince Imperial. A little difficulty in the matter of dates arises here, but at any rate, as we have seen, the plan, if there ever was such a plan, came

to naught, as any one acquainted with Fabre might have known that it would.

Several events of importance in Fabre's life fall within this Orange period, which extended from 1870 to 1879. It was at Orange that he lost his beloved son and co-worker, Jules, a youth of exceptional gifts and the delight of his father's heart. No less passionately devoted to the study of nature than was his father, Jules appears to have surpassed him in certain finer qualities of native endowment. For example, so delicate was his sense of touch that he could, we are told, distinguish plants and tell their names by simply feeling of their leaves. Could a naturalist have asked for a more congenial, a more delightful companion for his walks and talks in the field and his studies of the plants and insects that he kept about him at home for more leisurely and more careful examination? The death of this ideal comrade and collaborator was so severe a blow to the loving father that to the very end of his life a chance reminder of the loss was enough to shake him with sobs of bitter grief. A dedicatory note to the second volume of the "Souvenirs" pays melancholy tribute to this lost son, in the following affectionate words:

TO MY SON JULES.—Dear child, my ardently devoted collaborator in the study of insects, my clear-eyed assistant in botanical research, it was for your sake that I began to write these volumes, in memory of you I have gone on with the work, and in the bitterness of my bereavement I shall still go on. Ah, how hateful is death when it cuts down

the flower in the bright beauty of its blossoming. Your mother and your sisters lay upon your tomb garlands gathered in the rustic flower-bed that was once your delight. To those garlands, withered in a day's sunshine, I add this book, which will, I hope, have a to-morrow. Fortified as I am by my indomitable faith in a Beyond, the book seems to me to carry on the studies that we once pursued together.

An event that came near to being even more mournful in its consequences than the death of this talented son was the severe illness of the father in the same year. His own account of his narrow escape reveals the philosopher calmly and uncomplainingly awaiting the end—even watching its approach with the impersonal interest of the scientist noting the issue of an experiment. In a paragraph referring in its opening lines to his study of an important genus of small solitary bees, the naturalist writes:

“In the month of February, after a severe winter and when the ground had been covered with snow for a fortnight, I wished to see how my *halicti* were getting along. But I was in bed with pneumonia and to all appearances at death's door. Thank God, there was little or no pain, but I found it very hard to keep alive. Being unable, with the little clearness of mind left me, to engage in any other sort of observation, I observed myself in the act of dying. I watched with curious interest the gradual breaking down of my poor machine of a body. Had it not been for the terror of leaving my dear

ones—my children were still young—I would willingly have made my exit. On the other side there must be so many things, so many higher and nobler things, for us to learn! But my hour had not yet struck.”

Fabre’s disposition to welcome death at this time was the serene resignation of a good and wise man, but it was also the result, in great measure, of the increased anxieties that harassed him and of the petty persecution that had followed him even into his obscure retreat. In 1873, the year in which his friend Mill suddenly died at Avignon, the curatorship of the Requien Museum was abruptly and brutally and without a word of explanation taken from him. Since leaving the town he had continued to discharge the duties of the office, going twice a week from Orange to Avignon for the purpose. Secret and spiteful manœuvering may be detected in this shameful proceeding, which wounded him to the quick. As he indignantly declared in a letter to the mayor of Avignon, he had been dismissed “with less ceremony than would have been used in discharging a hall-boy entrusted with the handling of broom and feather duster.” Even more than the disgrace he regretted leaving the botanical collection that spoke to him of the zeal and learning of Requien, his teacher and his friend, as also of the volunteer assistance of Mill, and of his own labors as a collector. There was no assurance that his successor would give proper care to these perishable treasures, and certainly no one else was likely to carry to its conclusion the assembling of the com-

plete flora of Vaucluse in which Fabre had been engaged for many years as a labor of love.

The death of Mill, a keenly felt loss to the man he had so generously aided in time of need, must not be passed over without mention of Fabre's scrupulous care to repay the loan at the earliest possible moment. It must have been no easy matter for the discharged teacher to save up the three thousand francs needed to square the account—so far as mere money could square it. Nevertheless the thing was accomplished, and even long after the event Fabre was insistent that his biographer should tell the world of this repayment and emphasize anew the undying gratitude of him to whom the money had come as manna from heaven.

It was in this Orange period, spent chiefly in study and writing, that Fabre's great work, his "Entomological Souvenirs," was begun. For the sake of brevity this work has, in the foregoing pages, been referred to simply as Fabre's "Souvenirs," a title quite appropriate to the miscellaneous and autobiographical character of the volumes, even though they do record especially the author's entomological studies.

Near the end of the year 1878 he found that he had a sufficient number of descriptive articles on beetles and wasps and other insects to make up a volume; and so they were collected and put into shape and provided with an appropriate introduction, and then sent to Paris to be printed. Need enough there was, too, for all the revenue that could be derived from these products of the pen. The

late war with Germany had sadly interfered with the receipt of book-royalties from the capital, especially during the siege of that city and its consequent exclusion from the outside world. It is also to be noted that Fabre's writings always appeared in a form as unpretentious as their author. Of small size, printed on cheap paper, bound in pasteboard, and having sometimes only a few rather simple wood-cuts as illustrations, his elementary science manuals sold at but a few francs apiece, or sometimes at less than one franc; and until they obtained a footing in the schools of France, as they eventually did, they had too small a sale to yield the author much of an income. But to this unfortunate circumstance we are probably indebted for the great number and variety of Fabre's writings. Less grateful are we for his habit of repeating himself in paragraphs and even whole chapters that recur, without a word of apology or explanation, in volume after volume. Great was his need of material for as many volumes as possible, but we cannot cordially approve of this custom of selling the same wares over and over again. Nevertheless it remains true that he wrote rapidly and interestingly on all branches of science for young readers. Indeed, he could not do otherwise than write as he talked, which was clearly, simply, instructively, and entertainingly.

In this same clear and simple manner, though with the use of a few terms not familiar to many young readers or to all older ones, he introduces his beginning volume of the later and larger undertaking, the "Entomological Souvenirs," a work that

was in the end to fill ten good-sized volumes.

“This was how it happened,” he starts off, with engaging abruptness and informality. “There were five or six of us: I, the oldest, the teacher of the others, but still more their comrade and friend; they, young, warm-hearted, with lively imaginations, and overflowing with that spring-time sap of life that makes us so expansive and so eager to learn new things.

“Chatting on one thing and another as we followed a path bordered with dwarf elder and hawthorn, where already the yellow flower-beetles were reveling in the bitter-sweet fragrance of the opening blossoms, we went forth to see whether the sacred scarab had made its first appearance for the season on the sandy plateau of Angles and was rolling its little ball of dung, which to the ancient Egyptian typified the round earth we live upon. We were going to see also whether the little brook at the foot of the hill would not have, under its carpet of water-lentils, a few young tritons with coral-like gills; and to see whether the stickleback, that graceful little fish of our small streams, had donned its wedding cravat of azure and purple. We wished, further, to find out whether the swallows had arrived and were skimming the meadows, hunting the crane-fly, which dances about as it lays its eggs; and whether the spotted lizard was sunning its blue-speckled body at the mouth of a burrow hollowed out in the sand; and also whether the laughing seagull had come up from the sea in the wake of the legions of fish that ascend the Rhone to spawn in

its waters—whether, I say, the sea-gull had also arrived and was soaring in flocks over the river, uttering now and then its peculiar cry, which is so like a maniac's burst of laughter; and whether— But let that suffice; it is enough to say that we, simple and unpretentious folk, taking a lively pleasure in spending our days among the birds and the animals, were going forth to enjoy a morning in the unspeakably delightful festival that recurs every year with the springtime awakening of life.”

The scarab here mentioned is, of course, the well-known dung-beetle held in reverence by the ancient Egyptians and common along the shores of the Mediterranean. Angles is a sandy table-land not far from Avignon. Fabre's companions on this joyous excursion were undoubtedly his own children, with perhaps one or two of their playmates and possibly with the mother of the family also included; for they all, mother and children alike, joined heartily in the natural-history studies of the father. The great naturalist's enthusiasm for nature-study was contagious, and those living in the same house with him were the first to be fired with his zeal.

And now comes the last of Fabre's changes of abode. The immediate cause of this removal was an incident as commonplace, as little romantic, as his late expulsion from the house he had rented from the prudish old maids of Avignon. It chanced that the owner of his Orange residence took it into his head one day to cut down the two magnificent rows of plane-trees bordering the road that led to the naturalist's door. Their shade had been most

grateful in summer, and their foliage sheltered countless hundreds of chirping little birds and strident cicadas. Naturally, therefore, the lover of birds and insects and trees and all beautiful growing things grieved at the loss of these stately ornaments of the avenue in front of his dwelling and was indignant with the perpetrator of the wanton slaughter; so indignant was he that, having by this time amassed a sufficient sum of money to buy a modest home of his own, with grounds large enough for lettuce-culture and insect-study, he gathered together his household possessions, shook the dust of towns from his feet, and withdrew to the pastoral quiet of Sérignan, a little village to the northward of Orange and on the other side of the Aigues River, but still within the limits of that sunny Mediterranean region so rich in the plants and animals, and notably the insects, that continued to the end to be Fabre's unfailing delight.

CHAPTER XVI

WHEN THE DESIRE COMETH

AT last our naturalist, well past the half-century mark, but never more vigorous, never more keenly alive, found himself the proprietor of a little domain in his own right and no longer dependent on the whims and sudden impulses of unsympathetic landlords or, worse still in his experience, of prejudiced landladies. With a considerable garden and a stretch of waste land attached to his house he could now realize the desire of his heart, which was to be able to pursue his studies of insect life at his leisure and sheltered from the curious gaze of passers-by and the officious interference of perplexed and blundering emissaries of the law.

The story, as told by himself, of his menagerie of tiny specimens of animal life is delightful. The homeliest contrivances, such as wire-gauze dish-covers and old bottles and empty pill-boxes, were made to serve his purpose in solving many of the problems of insect habit and insect instinct, so far as these fascinating problems could be solved. Just as he was fond of proving by many examples that the bodily equipment of an insect gives little indication of that insect's peculiar mode of activity, which is determined by some inner urge, some native endowment, so with him his material equip-

ment in the way of apparatus gave no promise of the wonderful results he attained. With the odds and ends picked out of a rubbish-heap he could accomplish more than another scientist would with the best of instruments and appliances from the warerooms of Paris. All things are possible to genius. The Italian astronomer Schiaparelli, with an antiquated telescope and defective eyesight, would scan the heavens and discover things hidden from other searchers enjoying every advantage of keen vision and the most modern of astronomical telescopes.

Before entering upon the entomologist's daily life and all-absorbing investigations and experiments within the secure shelter of his high-walled retreat, let us picture to ourselves his household as it was then constituted. His aged father, the unsuccessful restaurant-keeper, had come to spend his last years with the son who had so long been his main dependence in the ups and downs—mostly downs—of a struggling existence. Of Fabre's five children by his first wife, several appear by this time to have flitted or to be flitting from the family nest; and soon after the removal to Sérignan their mother died, her place to be taken in two years' time by a young and capable woman whose able management saved her husband from those domestic distractions and vexations that would have seriously interfered with his chosen pursuits. Three children, as has already been recorded, were the fruit of this marriage, and were to cheer and rejuvenate the father's heart in this final period of his life. One of these

children, Paul Henri, the "little Paul" whom we shall learn to know better before we have done with him, still remains at the old home, where he is engaged in illustrating the new and annotated edition of the "Souvenirs." And one of the daughters, Aglaé, by the first marriage, is there also, devotedly caring for the house which has now been made a national memorial to her father. The faithful old manservant, Favier, a veteran of many campaigns, was not the least important member of the household.

The second marriage, it may here be said in passing, was regarded by all the gossips of the neighborhood as an extremely dubious venture. An old scholar of sixty or so marrying a girl in the bloom of youth! What could you expect but a disastrous and scandalous outcome to such a piece of folly? Well, the gossips were wrong, as they often are. Fabre's instincts and intuitions had not played him false. Inheriting his father's inaptitude for the practical concerns of life, the naturalist nevertheless did the one practically wise thing that the situation demanded, and all went smoothly thereafter in the Fabre household. Without the three younger children, the solace of his old age, and especially without "little Paul" as a willing and keen-sighted helper in his insect researches, what could he have accomplished in those later years in the way of enthusiastic and fruitful work? His heart clamored for little children to love; his hand needed their help in his daily occupations.

In his "Souvenirs" Fabre speaks of his little

property at Sérignan as "the Harmas," this strange word being a local term and meaning a tract of uncultivated land, a waste or desert on a small scale. But, though barren and stony, it was admirably suited to his purpose and was not quite beyond the possibility of cultivation. At least he managed to have a garden, and on the less promising portions of the estate he raised wild flowers and other plants native to the region and attractive to the insects he was studying. As far as was possible he wished his grounds to include the flora and the fauna, or the lesser fauna, of this richly endowed Mediterranean district. Thus, and thus only, could he achieve his long-cherished purpose of carrying on his natural-history studies without going very far or very often beyond the bounds of his own domain. It is true that occasionally his inquiries led him outside its walls, as when he experimented on the remarkable homing instinct of the mason-bee; but for patient and prolonged study of insect metamorphosis, for example, he could usually contrive to have all the requisite material within his own grounds and under his constant scrutiny and control.

"I have at last what I have been longing for," he writes, in jubilant mood, "a patch of ground, not large by any means, but walled in and secure from the annoyances of the public highway—an abandoned, barren, sun-scorched patch of ground, but hospitable to thistles and to wasps and bees and other gauzy-winged insects. Here, without fear of interruption from passers-by, I can put my ques-

tions to the digger-wasp and the sand-wasp and devote myself to that difficult intercourse in which question and answer take the form of experiment. Here, with no need of distant excursions, which take up so much time, with no fatiguing tramps that leave the attention less alert than it should be, I can plan my methods of attack, lay my ambuscades, and watch the results from day to day and from hour to hour. This is what I have been longing for; yes, it has been my heart's desire, my dream, always cherished and always eluding me in the obscuring mists of the uncertain future.

"But it was no easy matter to acquire an open-air laboratory of one's own when one was constantly harassed by gnawing anxiety as to whether the needed daily bread would be forthcoming. For forty years I have contended with indomitable courage against the petty ills of life, and now at last the laboratory so ardently desired has come to me. What it has cost in dogged perseverance and desperate toil I will not try to tell; enough that it has come, and with it, what is still more essential, a little leisure—perhaps. I say 'perhaps' because I still drag after me a few links of the convict's chain. But my desire has come. It is a little late, my dear insects. I fear the peach is offered when I am beginning to lack teeth for biting into it. Yes, it is a little late; the wide horizons of youth have taken on an altered look, becoming narrower, more confining, day by day. Regretting nothing in the past except the loss of those I held most dear, regretting not even my twenty years of hope deferred, and

now no longer hoping for anything, I have reached the point where, bruised and sore from harsh experience of life, one asks oneself whether life is worth living.

“Amid the ruins that surround me one fragment of wall still stands firm on its base of solid mortar. I refer to my love of scientific truth. Is it not enough, my busy bees and bustling wasps, to try to add, in worthy fashion, some few pages to your history? Will strength be equal to the undertaking? Why, you may ask, have I so long forsaken you? Friends have reproached me for it. But tell them, those friends that are at once yours and mine, that it was not forgetfulness on my part, not weariness or desertion. I was thinking of you; I was well persuaded that the mason-bee’s nest still had some rare secrets to reveal, and that the digger-wasp was reserving for us some fresh surprises. But time was lacking; I was alone, forsaken, struggling against misfortune. Before indulging in the delights of research one must provide for one’s daily bread. Tell them that, and they will excuse me.

“Others have complained of my style, saying that it lacks seriousness—let us say rather, academic dryness. They fear lest a page that one can read without fatigue may not always tell the truth. According to them, unless a writer is obscure he is shallow. Come hither, all you little creatures that have stings or wing-sheaths, hear my defense and testify in my behalf. Tell those doubters in what intimacy I live with you, how patiently I observe you, how scrupulously I record all your actions.

Your testimony is unanimous: my pages, though they do not bristle with high-sounding terms, though they are not a rigmarole of empty pomposity, nevertheless give an accurate account of things observed—nothing more and nothing less. Whoever cares to question you as I have questioned you, will get the same answers as I have got.

“And then, my beloved insects, if you cannot convince those good people, for lack of necessary tiresomeness and heaviness, I will address them in my turn, and I will say to them: You rip open the little creatures, but I study them as they live; you make them an object of repulsion and of pity, but I cause them to be loved; you work in a chamber of torture, of dismemberment, but I observe under the blue sky and amid the shrilling of the cicadas; you apply chemical reagents to the tiny cell and the bit of protoplasm, but I watch the promptings of instinct in its highest manifestations; you scrutinize dead matter, but I examine what is alive. While I am about it, why should I not make a clean breast of the matter? The wild boars have muddied the clear water of the springs, and natural history, that study so beautifully adapted to youth, has become a thing odious and repulsive. Now, if I write for the learned, for the philosophers who will some day try to throw a little light on the obscure problem of instinct, I write also and especially for the young, whom I wish to make love the natural history that you make them hate so bitterly; and that is why, while sticking closely to the truth, I will have none of your scientific lingo which, too

often, alas, sounds as if it had been taken from some North American Indian language.

“But all this is quite apart from what I wish to say just now. I started to tell about the little plot of ground so precious to me in my project of having a laboratory of live insects—the plot of ground that I have at last acquired in the solitude of a small village. It is a *harmas*, by which is meant in rustic speech an uncultivated tract of land, strewn with stones and given over to wild thyme. The soil is too thin to pay for plowing. In the spring, when it happens that there has been a little rain to start the grass, a flock of sheep may come this way. However, my *harmas*, because it chanced to have a small quantity of red earth sprinkled in with its inexhaustible supply of stones, did once upon a time receive a little cultivation. I am told that grapes were formerly raised here, and as a matter of fact when holes were dug for setting out a few trees, the remnants of grape-vine roots, half decayed by time, were unearthed. The three-tined fork, therefore, the only farming-implement that can penetrate such a soil, has been at work here; and I deeply regret the fact, for it drove out the primitive vegetation. No more wild thyme in my grounds, no more lavender, no more scrub oak, that dwarf variety that forms thickets over which one strides with a little effort. As these natural growths, especially the first two, could be of great service to me in affording pasturage for bees and wasps and other gauzy-winged insects, I am obliged

to reinstate them in the soil whence they have been banished by the spading-fork."

Then follows a sort of catalogue, picturesque in its descriptive terms, of the various wild plants still to be found in abundance scattered over the modest domain. "Such is," the paragraph ends, "or rather such was, when I took possession of it, the delightful Eden in which I hope to live henceforth in the closest of relations with my insects. Forty years of desperate struggle have earned for me this reward.

"I said 'Eden,' and from my present point of view the term is not ill-chosen. This rejected plot of ground that no one would have coveted even for raising turnips happens to be an earthly paradise for the insects with wings of gauze. The luxuriant growth of thistles and centaury that is found here attracts these tiny creatures from all directions. Never in my many entomological rambles have I met with so rich and varied an assemblage. Insect habits of a wide variety may here be studied in one small patch of ground. There are here all sorts of game-hunting insects; there are builders in clay, cotton-weavers, leaf-cutters, cardboard-workers, plasterers, wood-borers, underground tunnelers, artisans expert in the making of membranous partitions—in short, countless varieties of tiny artists."

A word as to the house, the main feature of this modest estate. It was, and still is, a square, two-story building with rooms opening to right and

of the central entrance hall, and two wings in the rear, one of them prolonged by the addition of a small greenhouse, an indispensable adjunct for the working naturalist. That Fabre was able to acquire so comfortable and suitable a home for himself is gratifying evidence of the considerable popularity of those little text-books of elementary science that he had been so busy upon at Orange. For a few years at least he seems really to have been measurably care-free on the subject of ways and means, and the pity of it is that this comparative prosperity did not last. But he was quite lacking in the pushful commercial temperament (his admirers now rejoice that this was so), and therefore he fell behind in the fierce competition from which even the realm of literature is not exempt. Many a half-humorous, half-bitter allusion to this most lovable lack in his own make-up is scattered through his writings, and it is pathetically evidenced in the home-made pieces of apparatus that are still preserved in the house and garden where they once played their useful part toward making the "little creatures" beloved of Fabre reveal their secrets to him.

It was like the man to surround himself not only with unresponsive insects, but also with more sympathetic pets, such as our common domestic animals and some that are not so common. His cats furnish material for a delightful chapter from his *book*, which will be drawn upon later; his faithful dog, too, shares in this literary immortality; and there are other references to the dumb companions

that, unlike some of his human associates, never betrayed his trust. Two tortoises still linger as relics of the now sadly depleted household; and if the younger of these armored reptiles cannot proudly claim to have held a place in the master's affections, the older one certainly can. A recent visitor to Sérignan, Mr. Charles Buxton Going, writes in "The Century Magazine" for October, 1922:

"No one seems to know what relationship, if any, this pair of beasts bear to each other, nor even if Sophie might not more fittingly be named Michael or Jean. But 'Sophie' it is, and has been for more than thirty years. She (to give 'her' the pronoun belonging to the gender of her name) scrambles from one end of the garden to the other with astonishing quickness in the trail of any party of humans, and announces her arrival by butting her head, or, rather, the front edge of her shell, violently against some one's boot, rising high on her legs, and from this leverage launching herself forward like a battering-ram, occasionally stopping to nip the edge of the sole with her beak for variety. It is not done, apparently, as a demand for food. Sophie finds herself well among the abundant small game of the garden. It seems rather to be an urgent request for attention, though no one seems to know just what caress is expected or how any could be bestowed."

CHAPTER XVII

A PUZZLING PROBLEM

IT will help us to know Fabre better and to appreciate more intelligently his patience and thoroughness, his ingenuity and skill, as an investigator of insect traits and habits, if we join him, in imagination, while he works out, as far as it is possible to do so, the solution of various interesting problems of insect life. Among these problems that occupied his attention was that of the homing instinct of certain hymenoptera (the order of insects characterized by four membranous wings and including bees, wasps, and hornets). This instinct, which is shared by many other members of the animal kingdom, enables the mason-bee, for instance, to find its way back without hesitation to its nest after being removed in a closed receptacle to a distance not beyond its powers of flight. What discoverable aids are there, queried Fabre, to guide the insect in this marvelous performance? Darwin, too, was puzzled by the same problem, and the two scientists corresponded on the subject a short time before Darwin's death. The French naturalist pays generous tribute, in his "Souvenirs" to the English evolutionist, with whom, let it be observed, he vehemently disagrees more than once in the course of his writings.

"One passage especially," Fabre writes, "had

impressed the English scientist in reading the first volume of my 'Entomological Souvenirs,' and that was my description of the faculty possessed by mason-bees of finding their way back to their nest after being removed to a great distance. What have they to serve them as compass on this return journey? What sense guides them? The profound observer wrote to me then of an experiment that he had long desired to carry out with pigeons, but had always postponed in his preoccupation with other studies. This experiment he suggested that I should undertake with my insects. These being substituted for birds, the problem would remain the same. I quote from his letter the passage concerning the proposed experiment." Darwin's words, as given by Fabre in English, are as follows:

" 'Allow me to make a suggestion in relation to your wonderful account of insects finding their way home. I formerly wished to try it with pigeons; namely, to carry the insects in their paper *cornets* about a hundred paces in the opposite direction to that which you intended ultimately to carry them, but before turning round to return, to put the insects in a circular box with an axle which could be made to revolve very rapidly first in one direction and then in another, so as to destroy for a time all sense of direction in the insects. I have sometimes imagined that animals may feel in which direction they were at the first start being carried.' "

After giving the substance of this in French, Fabre proceeds:

"This experiment seemed to me very ingeniously

conceived. Before going westward I was to start in the opposite direction. In the darkness of their paper dungeons my prisoners would be conscious, when I moved them, of nothing further than motion in a certain direction; and unless some disturbing cause should confuse that sense of direction the insects would retain it as a guide for finding their way home on being released. Thus would be explained the return to their nest of my mason-bees after they had been removed to a distance of three or even four kilometers. But if, after the insects had received the impression of being carried eastward, a rapid whirling motion should be given to them, first one way and then the other, they would quite lose their bearings, would remain unaware of my reversing my direction, and would retain their original impression of movement eastward. While I was carrying them to the west it would seem to them that they were still moving to the east; and this false impression would hopelessly confuse the little creatures. On being set free they would fly off in just the opposite direction to the homeward one, and would never find their way back.

“This result seemed all the more likely by reason of accounts that were current among the country people around me of occurrences calculated to confirm my expectations. Favier, an invaluable man for this sort of folk-lore, was the first to give me information. He told me that upon giving a cat a new home and carrying it from one farm-house to another at some distance, it was customary to put the animal into a sack and whirl it rapidly about be-

fore starting. This operation was thought to be a sure preventive against the cat's return to its old home. Many others, after Favier, told me of the same custom. According to them this rotation in a sack never failed for its purpose: the bewildered cat never came back. I sent to England an account of what I had thus learned, telling the philosopher of Down how the peasants had anticipated the investigations of science. Charles Darwin was astonished, I was no less so, and we both felt almost complete confidence in the success of the proposed experiment.

"This interchange of letters took place in winter, so that I had plenty of time to prepare for the experiment that was to be undertaken in the following May.

" 'Favier,' said I one day to my assistant, 'I must have some of those nests that you know about. Go over to our neighbor's house and ask permission to climb up under the shed roof. Take with you some new tiles and some mortar, which you will get at the mason's, remove a dozen of the most thickly inhabited tiles from the roof, and replace them with new ones as fast as you take the old ones away.'

"So it was done, my neighbor very willingly consenting to this exchange of tiles, as he is obliged, from time to time, to demolish the work of the mason-bees if he does not wish to see his roof cave in some day. I was merely anticipating a piece of repair-work that had to be done every year. That same evening, I found myself the possessor of a

dozen fine clusters of mason-bees' nests, each cluster rectangular in shape and adhering to the convex side of a tile, or the side toward the interior of the shed. I had the curiosity to weigh the largest cluster, and it tipped the scales at sixteen kilograms. The roof that it came from was lined with similar clusters, close together, over an extent of seventy tiles. Taking half the foregoing weight as a fair average for one of these clusters, we find the mason-bees' entire work on this one roof to weigh five hundred and sixty kilograms. And some roofs, I was told, were even more heavily burdened than my neighbor's. If you let the mason-bees build to their heart's content in a favored situation, if you let the work of generation after generation pile itself up, sooner or later the roof will come crashing down under the tremendous strain. There is danger, too, if the nests are allowed to remain and to become saturated with moisture, that fragments big enough to crack your skull will fall on your head. And all this is the work of a very little-known insect."

The full force of the foregoing will be appreciated if it is borne in mind that the kilogram is equal to about two and one fifth pounds. No wonder Fabre's neighbor was willing to have a few of his overpopulated tiles replaced with untenanted ones. The narrative continues:

"For the end I had in view, this rich booty was inadequate, not in point of quantity, but of quality. It came from a neighboring house separated from mine by a small field of grain and some olive-trees. I had reason to fear lest the insects from those nests

should retain some hereditary traits derived from their ancestors, denizens of that same shed for many a long year; and so the exiled bees would perhaps return thither, led by inveterate family habit; they would go back to the ancestral shed and build their nests there anew. As it is customary nowadays to assign a very important part to these hereditary influences, it behooved me to allow them no place in my proposed experiment. I needed bees from some place so distant that there should be no danger of their finding their way back thither.

“Favier undertook to manage this. He had discovered, on the banks of the Aigues River, several kilometers from the village, a deserted shanty in which the mason-bees had established a large colony. He wished to take the wheelbarrow for bringing back the nest-clusters, but I dissuaded him by pointing out that the jolting of the vehicle might injure the occupants of the cells, and that a basket carried on his shoulder was preferable. He took a helper with him and set out. The net result of this expedition was four tiles densely populated; that was all they could carry between them, and they were nearly used up on their arrival. Le Vaillant¹ tells us of a nest of republican swallows that he loaded on to a cart drawn by two buffaloes. My mason-bees showed themselves worthy rivals of the South African birds: the yoke of buffaloes would have made none too strong a team for transporting in its

¹ François Levaillant, or Le Vaillant (1753-1824), a French ornithologist who traveled in southern Africa in 1781-85, and published accounts of his travels (1790 and 1796).

entirety the colony of mason-bees' nests from the banks of the Aigues.

"The next step was to find a place for my tiles. I wished to have them within sight and so situated as to make it easy for us to watch them; for thus I should be spared the petty annoyances and inconveniences that I had formerly experienced, such as repeated ladder-climbing, prolonged standing on a rung that hurt the soles of the feet, and the beating of the sun's rays against a wall heated to the sizzling point. It was also essential that my little charges should find their quarters with me about like their former ones. I had to make their life a happy one if I hoped to induce them to remain in their new abode. Well, I found that I had at my disposal exactly the place for them.

"There was a wide porch facing a terrace, with plenty of sun at the sides and shade at the back. This was the proper situation for both parties, shade for me and sun for my tenants. Each tile was first provided with a hook of stout iron wire and then hung against the wall at the height of the eyes. Half of my nests were suspended at the right and half at the left. The general appearance of the whole was queer enough. Any one approaching and seeing my exhibit for the first time mistook these strange objects for pieces of salt meat, thick slices of some outlandish kind of bacon hung in the sun to dry. When the mistake was corrected there was invariably great wonderment at these beehives of my invention. News of them spread through the village, exciting much ridicule, and I was called the keeper

of a swarm of bastard bees. Who can tell what damage my reputation suffered from this freak of mine?

“Before the end of April my hives were in full activity. At the height of their busy season the swarm formed a buzzing and whirling cloud. The porch was a passageway in frequent use and leading to a store-room containing various kinds of household supplies. My family was at first disposed to reproach me for establishing thus among us this dangerous community. No one dared to go and get anything from the store-room, for it was necessary to pass through the cloud of bees at the risk of being stung. I was obliged to demonstrate beyond the shadow of a doubt that my bees were of the most peaceful disposition, incapable of a hostile act unless seized with the hand. I brought my face almost into contact with one of the nest-clusters when it was fairly black with working bees; I ran my fingers along the rows of cells, placed some of the bees on my hand, stood in the very midst of the buzzing throng—and not a sting did I receive.

“The peaceable disposition of these insects was known to me from long experience. I used to share the common fear and would hesitate to approach too near a swarm of mason-bees; but now I am well rid of this timidity. Don’t molest the little creatures, and they will never once think of harming you. At the very utmost, one of them may now and then, out of curiosity rather than in anger, come buzzing before your face and looking at you with some persistence, but with no threat of injury further than

buzzing. Let them alone; their inspection has no harmful intent.

“It took only a few proofs of this sort to reassure all the members of the family, after which big and little went back and forth through the porch quite unconcerned. My bees, far from being objects of fear, became a source of entertainment, and we all took pleasure in watching the results of their busy activity. But before strangers I was very careful to keep my mouth shut. If any one happened to call on business and stopped in front of the porch when I was standing before the hanging nest-clusters, there would be a brief dialogue something like this:

“ ‘They must know you pretty well, not to sting you?’

“ ‘Yes, indeed, they know me.’

“ ‘And how about me?’

“ ‘Ah, you—well, that ’s a different matter.’

“ ‘And the stranger would keep at a respectful distance, which was exactly what I desired.’”

CHAPTER XVIII

AN ATTEMPTED SOLUTION

THE material being assembled for his proposed inquiry into the mason-bee's homing instinct, Fabre set to work in earnest to discover if possible the secret of that instinct.

"The time came for me to carry out my experiments," he writes. "The mason-bees selected for the proposed journey had to be marked so that I could recognize them. A solution of gum arabic thickened with a coloring-powder, now red and now blue, or any other colour, was what I used for marking my travelers, the different colors preventing confusion among the various subjects of my successive experiments.

"At the beginning of these investigations I marked the bees on the spot where I set them free, and in performing this operation I was obliged to hold them, one at a time, between my fingers, a performance that cost me frequent stings, which were all the more irritating from their repetition, one right after another. Moreover, my handling was not always so delicate as to avoid serious injury to the travelers, whose wings were thus liable to harm of a nature to lessen their powers of flight. A better method, therefore, had to be devised, both for my sake and for that of the insects. It was neces-

sary to mark the bees, carry them to a distance, and release them, without grasping them in one's fingers and, indeed, without handling them in any way. This exercise of caution could not fail to contribute to the success of my experiments, and how I managed it I will now explain.

“When the bee, with its abdomen thrust into the cell, brushes off its load of pollen, as also when it is building its cell, it is wholly intent on what it is doing. It is easy then, without frightening the insect, to mark it on the back with a straw dipped into the coloring matter. The bee takes no notice of this light touch. It flies off and soon returns with another load of pollen or of mortar, as the case may be. The experimenter allows a sufficient number of these excursions to make sure that the mark is thoroughly dried, which does not take long with the sun as hot as it always is when the bees are active. The next thing is to catch the insect and shut it up in a horn of paper without touching the delicate creature. Nothing could be easier. A small glass bottle with a wide mouth is clapped over the bee while it is still absorbed in its work, and when it starts to fly away again it finds itself a prisoner in the bottle, whence it is readily transferred to the horn of paper, this latter being then immediately closed and placed in the tin box that is to hold all the bees during their removal to some distant point. When the time comes to set them free, all one has to do is to open the paper horns. Thus the whole affair is managed with no harmful pressure of the fingers on the captive bees.

“Another question remained to be considered before the experiment could go forward, namely: How much time should I allow before closing the count of bees returned to the nest? I will explain my meaning. The mark made on the bee’s back with the light touch of a straw dipped into the coloring-matter is not of the most durable sort, being confined merely to the down or fur of the insect. But it would have been no more lasting had I held the insect in my fingers when marking it. The mason-bee brushes its back frequently, dusting it off every time it leaves its cell; and, furthermore, its fur is continually being rubbed against the walls of its cell, which it must enter and leave every time it brings a fresh supply of honey. A mason-bee, wearing a good coat of hair at the outset, loses much of it as time passes; its fur is shorn, being rubbed down by work, just as the workman’s blouse is worn to tatters in course of time. Moreover, at night and during days of bad weather the mason-bee of the wall-inhabiting variety remains in one of its cells, into which it dives, head downward. The mason-bee that inhabits sheds follows nearly the same practice as long as there are empty cells available; but when this is no longer the case it seeks another retreat. On my lot of waste land are heaps of stones destined for use in the building of an enclosing wall; and it is among these stones that my mason-bees pass the night. In the crevice between two stones, one resting on the other with no tight joint between them, they station themselves in groups of many individuals, crowded together in

great confusion and with no separation of the sexes. One of these groups may contain as many as two hundred bees. The most frequented dormitory is a narrow groove, into which the insects tuck themselves as deeply as possible. I have seen some of them lying upside down, belly upward, like human beings asleep. In bad weather, as for instance when it is cloudy or the north wind blows, they do not stir out of their snug retreat.

“All these conditions being considered, I found that I could not count on any long continuance of the mark made on the insect’s back. In the daytime it was sure to be quickly effaced by the bee’s frequent brushing of its coat and by friction against the walls of the nest; and at night the case was worse still, in the confined dormitory to which the insects retired by the hundred. After a night passed in the crevice between two stones, the mark made just before could not with any certainty be expected to remain uneffaced. Consequently the counting of such bees as might return home after being carried to a distance had to be done without very much delay; the next day it would be too late. Therefore, it being impossible to recognize returned travelers whose markings had been effaced in the night, I decided to give my attention only to instances of return on the same day as the removal.

“It remained for me then to devise some sort of rotary machine. Darwin suggested my using a round box operated by means of an axle and a crank. But I had nothing of the sort at hand, and I concluded it would be simpler and just as effective

to adopt the device employed by the country person who wishes to confuse his cat by whirling the animal around in a sack. My insects, each one confined singly in a paper horn, I would place in a tin box, the paper receptacles being packed tightly so as not to be shaken up in the act of whirling. Finally, a string was to be tied to the box and I would swing this apparatus around my head like a sling. With this device nothing could be easier than to obtain such rapidity and variety of movement as I might desire for the purpose of making my captive bees lose their bearings. I could whirl my sling about, first in one direction and then in the opposite; I could increase or diminish its speed; I could swing it in double curves forming the numeral eight, with circles intermingled; and if I myself spun round on my toes at the same time, I should still further complicate the figure described by the sling. In such wise I determined to operate.

“On the second day of May, 1880, I made a white mark on the backs of ten mason-bees while they were variously engaged, some exploring clods of earth for the purpose of choosing a proper site for their cells, others occupied with masonry work, and still others storing away provisions. When the marks were dry I took the insects and imprisoned them in the manner just described. Next I carried them half a kilometer in the direction opposite to that in which I purposed to carry them finally. A path running along one side of my domain served me in my execution of this preliminary manœuvre, and I secretly prayed that I might find the coast

clear when the time came for whirling my sling. A cross stood at the end of the path, and at the foot of this cross I halted and swung my bees about my head in strict accord with the rules I had formulated.

“But it so happened that while I was making my tin box describe circles, first in one direction and then in the opposite, and while I was spinning around on my toes to produce the desired complication of motion, a good woman came that way and stared at me with wide-open eyes, very wide-open. Just think of it, my standing at the foot of the cross and cutting such foolish capers! The thing was talked about; it was nothing short of necromancy! Hadn’t I been seen a short time before digging up a dead body? Yes, I had gone to an old graveyard and unearthed some venerable bones. I had done that, and people knew about it, too. And now, to cap the climax, the wicked man was seen at the foot of a cross engaged in certain Satanic exercises.

“Never mind. But it took no little courage on my part to carry out my program in the presence of this unexpected witness. The whirling performance completed, I retraced my steps and continued on to the eastward of Sérignan, following the least frequented paths and cutting across lots to avoid, if possible, any fresh encounter. My cup of confusion would have been full if some one had been there to look on while I opened my tin box and released my bees. Half-way to my destination I halted and, to make my experiment more decisive, repeated my

rotary motions, making them as complicated as before; and I went through the performance a third time on reaching the spot chosen for the release of my insects.

“This spot was at the farther end of a stony plain having a thin growth of almond-trees and evergreen oaks. On a previous occasion, walking at a brisk pace and following a direct course, I had covered the distance in thirty minutes; consequently it is about three kilometers. The weather was fine, the sky being clear and a very light wind blowing from the north. I sat down facing the south, to leave the insects a perfectly free passage both in the direction of their nest and in the opposite direction. I released them at a quarter past two o'clock. Upon being set free, the bees, as a rule, circled around me a few times and then flew off at top speed toward Sérignan, so far as I could judge; but this was rather hard to determine exactly, the bee's departure being very sudden after it had flown two or three times about my person, a suspicious object which it seemed to wish to investigate before leaving the spot. A quarter of an hour later my eldest daughter, Antonia, who was on the watch near the nests, witnessed the arrival of the first of the homecoming bees. Upon my return toward evening two more came in. Total: out of ten bees released, three arrivals on the day of the experiment.

“The next day I repeated the performance. Ten mason-bees were marked with red, which would enable me to distinguish them from those that had returned on the preceding day, as well as from those

that might still show up with their white markings not yet effaced. I adopted the same precautions as on the day before, the same rotations in the same places, except that I did not repeat the rotary operation on the way, but went through it only at starting and on arriving. It was a quarter past eleven in the forenoon when the insects were set free, the morning being chosen as the time of day when the bees are at their liveliest and busiest. At twenty minutes past eleven Antonia saw one return to the nest. On the supposition that it was the first one released it made the homeward flight in five minutes; but in the absence of proof to the contrary it may not have been the first one liberated, and in that case the time of flight was less than five minutes. That speed, three kilometers in five minutes, is the greatest I have been able to note with certainty. At noon I reached home, and in a little while I saw three more of my red-marked bees come in, but saw no others later. Total: out of ten released, four arrivals.

“On the fourth of May, the weather being clear, calm, and warm, conditions favorable to my experiment, I took fifty mason-bees marked with blue. The distance to be covered was the same as before. The first rotary performance took place after the insects had been carried several hundred paces in a direction the reverse of the final one, three more rotary exercises were performed on the way, and a fifth was executed just before the release. If the little creatures had not lost their bearings by that time, it was not for lack of being spun around in all

sorts of ways. At twenty minutes past nine I began to open my paper receptacles. It was rather early in the morning, and consequently my bees remained for a moment undecided and inert after recovering their freedom; but at the end of a brief sun-bath on a stone where I placed them they took their flight.

“I was sitting on the ground, with my face to the south. On my left lay Sérignan, and on my right Piolenc. When the swiftness of flight was not so great as to make it impossible to note its direction, I saw my liberated captives dart off toward the left. Some, but only a few, went southward, and two or three westward, or toward the right. Of the northerly direction I say nothing, my body serving as a barrier on that side. In brief, then, the great majority flew to the left, or toward home. At twenty minutes to ten all the captives had been released. One of the fifty was found to be free of its marking when taken out of its paper cage; therefore I did not count it, and this reduced the number to forty-nine.

“According to Antonia, who was watching for the home-comers, the earliest arrived at twenty-five minutes to ten, or fifteen minutes after the beginning of the release. By noon eleven had come back, and by four o’clock in the afternoon seventeen. There the count ended. Total, seventeen out of forty-nine.

“A fourth experiment took place on the fourteenth of May. The weather was fine, with a light wind from the north. At eight o’clock in the morning I took twenty mason-bees marked with red,

whirled them around in the tin box after carrying them a certain distance in the direction opposite to the one finally adopted, gave them two series of rotations on the way, and repeated the performance on reaching our destination. As far as I could note their flight on being released, it was toward the left, or in the direction of Sérignan. I had taken precautions to leave the two opposite courses, eastward and westward, equally unobstructed, having even removed my dog when I saw him at my right hand. This time the bees did not circle about me, but some of them flew away immediately, while the others, constituting the majority, alighted at a few meters' distance and seemed to wait to recover themselves a little, being perhaps dizzy from the jolts and jars of their journey and the repeated rotary motion to which they had been subjected; then at last they flew away toward the left. This invariable speed of flight was noted every time it was possible to observe the insects' movements. I was home again by quarter to ten, and found two red-marked bees there ahead of me, one of them being at work building a cell, with pellet of mortar between its mandibles. By one o'clock in the afternoon seven had come back, but no more were observed after that. Total, seven out of twenty.

“Enough of these experiments. They were quite sufficient for the purpose in view, but had not resulted as Darwin had expected, and as I also had expected, especially after what I had been told about cats. In vain had I complied with the suggestions offered and had first carried my insects in the direc-

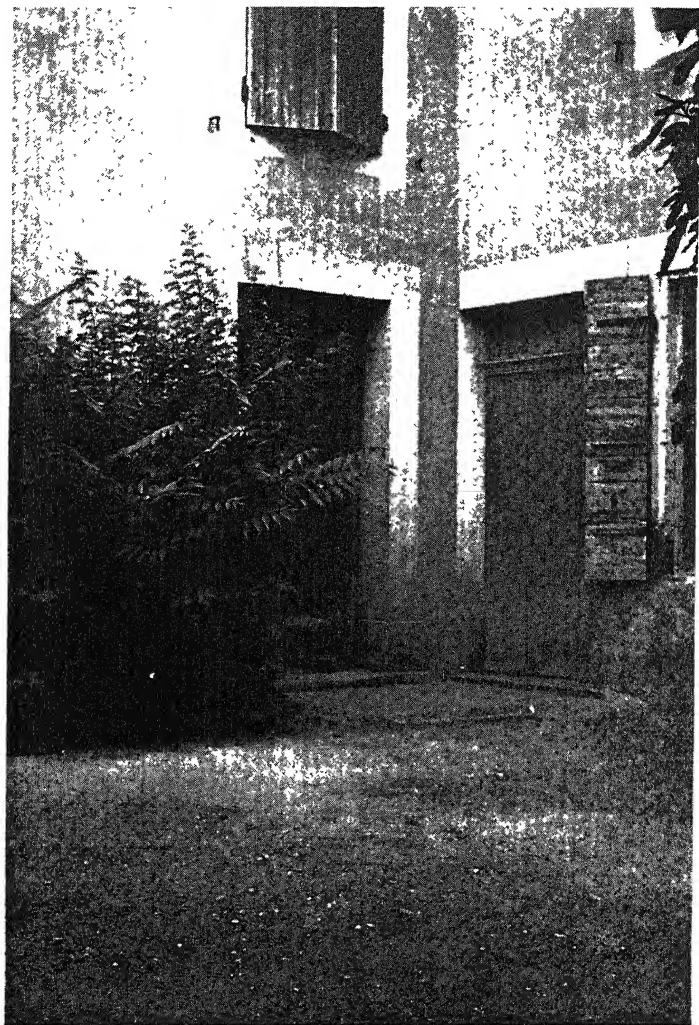
tion opposite to that in which lay the place selected for releasing them; in vain had I, before retracing my steps, whirled my sling with every complicated motion I could devise; and likewise in vain had I, in order to increase the bewilderment of my captives, repeated the rotary performance as many as five times, at setting out, on the way, and upon arriving at my destination. The expected result failed to follow. The mason-bees found their way home, the proportion of the returns on the same day as the experiment ranging from thirty to forty per cent. It came hard for me to abandon an idea suggested by such a master and accepted by me all the more willingly because I considered it likely to lead to a final solution of our problem. But there were the facts, more eloquent than any number of ingenious suggestions; and the problem remained as baffling as ever.

“The next year, 1881, I resumed my experiments, but with an important difference. Up to that time I had operated on a level stretch of territory, and hence my captives, in returning to their nests, had only insignificant obstacles to surmount, such as hedges and shrubbery and orchards. Now I proposed to add to the difficulty of distance certain other difficulties offered by the nature of the territory. Discarding all rotary motions and all doubling on my course, devices proved to be futile, I proposed to release my mason-bees in the thickest of the woods about Sérignan. How, I queried, would they find their way out of this labyrinth in which I myself had at first needed the aid of a compass in

order to get my bearings? Moreover, I was on this occasion to have the help of a pair of eyes much younger than my own and quicker to note the course taken by my insects in flying off. This impetuosity of flight in the direction of the nest had been observed again and again, and it was beginning to interest me even more than the actual return to the nest. A young student of pharmacy, at home for a few days with his parents, was to be my assistant and lend me the use of his eyes. In his company I was quite at my ease, as science was no stranger to him.

“Our experiment in the woods took place on the sixteenth of May. The weather was warm, with signs of storm and with a perceptible breeze from the south, but not enough to incommode my released captives. Forty mason-bees were taken for our purpose. Because of the distance we were to go I wished to save time in the preliminary processes, and therefore did not mark the bees at their cells, but deferred this to the moment of releasing them. This was my earlier method of procedure, and it involves getting stung; but I now adopted it as being more economical of time. I allowed an hour for reaching our destination. The distance to be covered was, therefore, about four kilometers, all allowance being made for turns and twists in the path followed.

“It was essential that the spot chosen for the release of the bees should be such that we could note the direction taken by them in flying off. I chose a clearing in a dense thicket. All about was a dense



Photograph by L. O. Howard

A DETAIL OF FABRE'S HOUSE

growth of trees, shutting off the horizon in every direction. On the south, in the direction of the bees' nest, was a range of hills some hundred meters higher than our selected position. The wind was slight, but it blew from the quarter toward which my insects would have to fly in order to reach home. I turned my back on Sérignan, so that the bees, in leaving my hand to return to their haunts, would be obliged to fly past me, to right or to left. I marked the insects one by one as I released them. It was twenty minutes past ten when this operation began.

"Half of the bees showed some want of alertness, fluttering about a little, alighting on the ground, and appearing to collect their energies before taking their departure. The other half were less dilatory. Although there was a light south wind to make head against, the bees all started off in the direction of their nest; all flew southward after describing a number of circles and loops about us. Not a single exception was noted, so far as we could observe their flight. This fact was established by myself and my assistant on 'good and sufficient evidence. My mason-bees headed southward as unerringly as if their course had been laid by compass.

"By noon I was at home. None of the exiles had at that time come back, but a few minutes later I captured two, and by two o'clock the number was increased to nine. Then, however, the sky clouded over, the wind increased in force, and there was prospect of a storm. No further arrivals could be counted upon. Total, nine out of forty, or twenty-two per cent.

“This proportion was less than those previously noted, which ranged from thirty to forty per cent. Is this difference to be accounted for by the difficulties that had to be overcome by the bees? Did some of the insects get lost in the woods? It would be imprudent to reply in the affirmative, for other causes may have operated to lessen the number of returns. I marked the insects at the moment of release, I had to handle them, and I cannot affirm that they all escaped uninjured from my fingers, which were smarting with stings. Then, too, the sky clouded over and a storm threatened. In this month of May, so changeable and capricious in my region, hardly one whole day of continuous fair weather can be counted upon. A brilliant forenoon may be followed by a dark and menacing afternoon, variations that have more than once affected my experiments with mason-bees. Therefore, all things considered, I should be inclined to say that the return flight over hills and through woods is accomplished as effectually as over open level ground and across fields of grain.

“One last device remained for me to try in my endeavors to confuse my mason-bees, and that was to carry them first a long distance away, then by a wide detour come back over another route and release them at a suitable distance from the village—say about three kilometers. A vehicle of some sort was needed, and my assistant of the woods offered me his little cart. With fifteen mason-bees we two set out on the road to Orange and proceeded as far as the viaduct. At that point there branches off to

the right the severely straight Roman road, the *Via Domitia*. We followed it as far northward as the Uchaux Mountains. There we swung around toward home by the Piolenc road and halted on the highest point of the Font-Claire plain, at about two and one half kilometers from our village. The reader can easily follow our route on the staff-office map, and it will be seen that the roundabout course pursued by us measures very nearly nine kilometers.

“Meanwhile Favier had come to meet me at Font-Claire by the direct route, the Piolenc road, bringing with him fifteen mason-bees to serve by way of comparison with mine. There I was, then, with two sets of insects at my disposal—fifteen, marked with pink, that had made the detour of nine kilometers, and fifteen, marked with blue, that had come by the direct road, the shortest route by which to return to the nest. The weather was warm, clear, and calm; no better conditions could have been desired for the success of my experiment. The bees were released at nearly noon.

“At five o’clock in the afternoon the number of arrivals was seven for the bees marked with pink, the bees I had thought to bewilder by a long and circuitous journey by carriage, and six for the bees marked with blue, that is, those that had been brought directly to Font-Claire. The two proportions, forty-six and forty per cent, were nearly equal, the slight excess for the insects that made the circuit being evidently accidental and therefore negligible. The roundabout route cannot have made

the bees' return any easier, and it is equally certain that it did not make it any harder.

"The demonstration was clear enough: neither complicated and repeated rotary motions like those I have described, nor the occurrence of hills to be surmounted and woods to be crossed, nor the adoption of a route that doubles on itself by making a wide circuit can be regarded as effective in confusing mason-bees that are carried to a distance and then set free to make the homeward flight.

"I wrote to Darwin and told him the negative results of my first experiments, in which whirling movements had been a chief feature. Expecting success, he was much surprised to learn of my failure. His pigeons, if he had had leisure to experiment with them, would have behaved as did my mason-bees: the preliminary whirling would not have troubled them. The problem called for another method of solution, and here is what he proposed to me:

" 'To place the insect within an induction coil, so as to disturb any magnetic or diamagnetic sensibility which it seems just possible that they may possess.' ¹

"To liken an insect to a magnetic needle and subject it to the influence of an induction current in order to disturb its magnetism or diamagnetism seemed to me, I must confess, a singular notion and one that could occur only to an imagination very hard pressed for ideas. I have little confidence in our physical science when it presumes to explain

¹ These are Darwin's own words, quoted in English by Fabre.

life; nevertheless my respect for the illustrious master would have made me resort to induction coils if I had possessed the requisite apparatus. But our village furnishes no such aids to research, and if I wish to produce an electric spark I have to rub a sheet of paper across my knees. My cabinet of scientific apparatus rejoices in the possession of a magnet, and that is all. This poverty of means being communicated to him, Darwin suggested another mode of procedure, simpler than the preceding and surer in its results. These are his own words:

“‘To make a very thin needle into a magnet; then breaking it into very short pieces, which would still be magnetic, and fastening one of these pieces with some cement on the thorax of the insects to be experimented on. I believe that such a little magnet, from its close proximity to the nervous system of the insect, would affect it more than would the terrestrial currents.’

“‘He still clung to his idea of making the insect a sort of magnetized bar on a small scale. Terrestrial currents he believed to be the guiding agency in the insect’s return to its nest. Being, then, a sort of living compass-needle, if it is rendered insensible to the earth’s influence by the application of a magnet it will no longer be able to get its bearings. In writing these lines I take refuge behind the great renown of the learned originator of the idea. From an obscure person like myself they would not be taken seriously. Obscurity may not indulge in these audacious theories.

“‘The suggested experiment seemed easy; it was

not beyond my modest means. I decided to try its effect. By rubbing a very fine needle on my magnet I converted the needle itself into a magnet, of which I kept only the sharp end, to the length of five or six millimeters. This fragment was a complete magnet in miniature, attracting and repelling another magnetized needle suspended by a thread. How to fasten it to the insect was now the question. Here my assistant, the student of pharmacy, placed at my disposal all the sticky substances in his laboratory. The best thing of this sort was a certain court-plaster made expressly by him with a very thin fabric. It had this peculiar advantage, that with only the heat of a lighted tobacco pipe the gum could be softened when the time came to apply the plaster on reaching the scene of action.

“I cut off a tiny square piece of the court-plaster to fit the insect’s back, and I ran the needle point through several threads of the fabric. All that then remained to be done was to soften the glue a little and apply the whole thing immediately to the mason-bee’s back, making the needle run lengthwise of the insect. Other like outfits were also prepared and the two magnetic poles of each needle were marked in a way to distinguish them, so that I might be able to point the south pole toward the bee’s head in some instances and the north pole in others.

“With my assistant to help me, the operation was rehearsed several times, as it seemed advisable to acquire some skill in execution before entering upon our experiment in the fields. Furthermore, I wished to see how the insect would behave in its

magnetic harness. I took a mason-bee that was working at a cell which I marked, and then I carried the bee to my study in another wing of the house. The magnetic apparatus was attached to the back and the insect set free. No sooner was it released than it let itself drop and proceeded to roll about on the floor in a perfect frenzy. Then it flew up and fell down again, turned over on one side, on the other, on its back, knocked against adjacent objects, and in general behaved in the most frantic manner. Finally it darted through the open window with impetuous speed.

“What did all this mean, I wondered. The magnetized needle seemed to exert a strange influence on the subject’s nervous system. What demoralization! What frenzy! The insect appeared to lose its wits as the result of my treatment and conducted itself in the craziest fashion. I hastened to the nest, to see what would be the issue there; nor had I long to wait. My mason-bee came back, but rid of its magnetic appendage. I recognized the little creature from the traces of glue still clinging to the hairs on its back. It had returned to its cell and was resuming its work.

“Being always on my guard in exploring the unknown, and having an unwillingness to reach a decision before weighing all the evidence, I found myself becoming more and more doubtful concerning what I had just witnessed. Was it really the magnetic influence that had so strangely upset my mason-bee? When it became so agitated, strug-

gling with wings and legs on the floor, and when it darted away in wild haste, was it in very truth acting under the influence of the tiny magnet fastened to its back? Did my device nullify the directing effect of the earth's magnetic currents upon its nervous system? Or was the insect's strange behavior due simply to the unaccustomed harness it was wearing? This remained to be decided, one way or the other, and without delay.

“Another contrivance was prepared, but with a tiny bit of straw in place of the magnetized needle. The insect to which I attached it rolled on the ground, turning over this way and that in great perturbation, just as the first one had done, until finally the irritating encumbrance was detached, taking with it some of the down from the insect's back. In short, the bit of straw had exactly the same effect as the piece of magnetized needle, which proved that magnetism had played no part in the experiment I had been performing. The thing attached to the insect's back had in each instance caused discomfort, and hence the violent efforts to get rid of it. To expect normal behavior from an insect while it carries on its back any such contrivance, whether magnetized or not, is like undertaking to study the customary habits and actions of a dog that has been infuriated by the tying of an old saucepan to its tail. Experiments with magnetized needles are impracticable. But supposing the insect to allow itself to be experimented upon in this fashion, what

should we learn? In my opinion we should learn nothing. In its effect on the home-returning bee a magnetized needle would differ not at all from a piece of straw."

CHAPTER XIX

CONCERNING CATS AND DOGS

SO all-embracing were Fabre's interests and affections that it is not out of place to show him to the reader as a lover of those most familiar of our domestic animals, the cat and the dog. Mark Twain, as is well known, had an exquisite appreciation of the cat's whims and humors, of its somewhat aloof and distrustful attitude toward human beings; but the dog's more warm-hearted, more generously impulsive and devotedly loyal nature failed to win his affection. Fabre could see and appreciate and love the peculiar qualities of both animals. The experiments described in the preceding chapter led him to inquire into the cat's well-known ability to find its way home after removal in a closed basket or box or other container to some distant spot.

"If whirling motions," he says, "are ineffectual in befuddling the insect, what will be the result if they are tried on the cat? Can we repose any confidence in the popular device of swinging a cat in a sack, to prevent its returning home? I used to think we could, so beautifully did the custom harmonize with the suggestion communicated to me by the illustrious master [Darwin], a suggestion that promised to account for so much that is puz-

zling in animal instinct. But after my experiments with mason-bees my confidence was shaken; the insect's behavior made me doubtful about the cat. If the one can find its way back after being whirled about in all sorts of ways, why cannot the other? In order to decide this question I undertook a second series of experiments.

“First of all, how far does the cat deserve its reputation of being able to find its way back to the beloved home, to the scenes of its amorous exploits on roofs and in garrets? The most curious things are related concerning its wonderful instinct, and children's books of natural history are filled to overflowing with accounts of astonishing performances that reflect the highest honor upon its talents as a wanderer. I hold these accounts in slight esteem; they come from hasty and uncritical observers, who are addicted to exaggeration. It is not given to every one to speak with strict accuracy on the subject of animals. When some inexperienced person tells me in regard to a certain animal that it is black, I set about investigating the matter to find out whether by chance the creature may not be white; and not infrequently the actual fact proves to be the direct opposite of the assertion. The cat is extolled in my hearing as an expert traveler. Very well; I shall consider the cat a greenhorn in the matter of travel. There the thing would have ended as far as I was concerned, had I been dealing merely with the testimony of books and of persons untrained in the rigors of scientific investigation.

But fortunately I am acquainted with certain facts that leave no room for doubt. The cat really deserves its reputation as an exceedingly alert and knowing traveler. I will relate these facts.

“One day while I was living at Avignon there appeared on the garden wall a pitiful specimen of a cat, its fur all ruffled, its sides hollow, its spine fairly saw-toothed from thinness. The poor creature was mewling as if half-starved. My children, who were then very young, took pity on its sufferings and offered it bread soaked in milk and attached to the end of a long reed. This morsel was accepted and more followed, until at last, its hunger satisfied, the animal departed, deaf to the calls of ‘Pussy, pussy,’ from its tender-hearted friends. But hunger returned and the famished creature appeared again at its feeding place on the wall. The same offering of milk-soaked bread followed, the same soft words were uttered, and the cat allowed itself to be wheedled. It came down from the wall and even permitted the children to stroke its back; but, heavens, how thin the creature was!

“It became the chief topic of conversation, it was discussed at table, and plans were matured for taming the vagabond, for adopting it, for providing it with a bed of hay. What a very serious business it was! I still see and shall always see that earnest council of giddy-pates deliberating on the fate of the cat. And they did, as a matter of fact, succeed in making the wild creature stay with them. Before long it developed into a superb tom-cat. Its

large round head, its muscular legs, and its reddish fur with darker spots scattered over it made the animal look something like a small jaguar. It was named Tawny, from its color. A mate was found for Tawny a little later, her addition to the household taking place much as did that of Tawny. Such was the origin of my series of Tawnies, as I recall it after nearly twenty years, with their vicissitudes of repeated moving.

“The first of the movings here referred to was in 1870, and the moving of the cats gave us some trouble. We were all attached to them, and it would have seemed to us a crime to leave them behind in want and doubtless exposed to the stupid malice of persecutors—those poor creatures that we had so often caressed. The little kittens and their mothers made the journey without inconvenience to any one, being placed in baskets and remaining quiet on the way; but with the old tom-cats it was a different matter. I had two of them, the founder of the line, the patriarch, and one of his descendants, as robust a specimen as the patriarch himself. We decided to take the grandfather if he didn’t offer too much resistance, and to leave the grandson behind, making proper provision for his maintenance.

“A friend of mine, Dr. Lorient, took charge of the one left behind. At nightfall the cat was carried over to his house in a closed basket, but scarcely had we sat down at the supper table and begun to congratulate ourselves on our Tawny’s good fortune when there came bounding through the open win-

dow an object all dripping with water. This shapeless mass of rumpled fur came and rubbed itself against our legs, purring with happiness.

"It was our cat. The next day I heard the story of his adventure.

"On arriving at Dr. Lorient's the cat was shut up in a room. Finding himself in strange quarters, the prisoner jumped up on to one piece of furniture after another, hurled himself against the window-panes, made havoc of the ornaments on the mantelpiece, and, in short, was in a fair way to work universal ruin in the room. Madame Lorient was terrified by the little maniac and hastened to open the window, through which the animal leaped into the street amidst the passers-by. A few minutes later he had regained his former abode. But this achievement was not without its difficulties. It was necessary to thread a rather intricate maze of populous streets and brave a thousand dangers, street gamins especially, and dogs; and finally there remained an obstacle perhaps even more serious, the Sorgues, a stream flowing through Avignon. Bridges were available, and in plenty; but the animal, in its eagerness to take the shortest cut, did not use any of them, leaping instead with great courage into the water, as was evidenced by its dripping fur.

"I was moved with compassion for the valiant tom-cat, so faithful to the home of its birth, and it was agreed that we should do our utmost to take him with us. But we were spared this trouble, for

a few days later he was found dead under a tree in the garden. The gallant creature had fallen victim to some brutal bit of malice. Some one had poisoned him. Who could it have been? Probably no friend of mine.

“The patriarch still remained, but he was not to be found when we took our departure, being out in quest of adventure, perhaps in some neighboring granary. Ten francs’ reward was offered to the carter if he would bring the cat to Orange with one of the loads that he still had to deliver; and on his last trip he did in fact bring the animal in the box under the driver’s seat. But when we opened the traveling prison in which the patriarch had been shut up all night, I had difficulty in recognizing my old tom-cat. He came out a terrifying spectacle—fur ruffled, eyes bloodshot, frothing at the mouth, spitting and scratching. For some time I thought him mad and watched him closely. But I was deceived: it was merely the fright of an animal removed from its familiar haunts.

“Had the cat offered stout resistance on being seized by the carter? Had he suffered hardship on the way? To these questions history makes no reply. But one thing I know well enough: the animal seemed utterly changed; no more friendly purring, no more rubbing against our legs, nothing but a wild look, a somber melancholy. Kind treatment was unavailing to soften the creature. He dragged his wretchedness from one retreat to another for some weeks, and then one morning I found him dead

in the ashes of the fireplace. Grief, on top of old age, had killed him. Would he have gone back to Avignon if he had had the strength to do so? I hardly dare affirm that he would. But I do regard it as remarkable that an animal should die of homesickness because the infirmities of age prevented a return to its old haunts.

“What the patriarch was unable to undertake, another cat accomplished successfully, though the distance involved was much shorter, it is true. A new removal was resolved upon in order to find at last the quiet necessary for my pursuits, and I sincerely hope there will be no more to chronicle. I left Orange for Sérignan.

“The Tawny family had undergone complete renewal, the old stock having been succeeded by new members, among them a full-grown tom-cat in all respects worthy of his ancestors. He alone was to cause us some trouble, the others, mother cats and kittens, submitting peacefully to the removal. Baskets were used as vehicles, and one was occupied by the tom-cat alone, as any other arrangement would have meant a disturbance. The transport was by carriage, my family accompanying. Nothing of importance occurred on the way. Taken from their baskets, the mother cats explored the rooms one by one. With their pink noses they identified the various articles of furniture, finding them to be the same old chairs, tables, sofas, and so on, though the rooms were different. There were little mewings of surprise, looks of inquiry; but a few caresses and

an offering of food quieted all apprehensions, and by the following day the gentle creatures were acclimated.

“Not so the tom-cat. He was lodged in the attic, where he would find ample room for cutting any kind of capers. Some one kept him company in order to lessen the tedium of his captivity, and he received a double allowance of plates to lick. From time to time he was brought into communication with some of his kith and kin, to assure him that he was not the only feline occupant of the house. In short, a thousand little attentions were lavished upon him in the hope of making him forget Orange, and he did actually appear to do so, showing himself gentle under caresses, coming to us in answer to a call, purring, and behaving beautifully in every way. Good: a week of confinement and kind treatment had apparently banished all thought of a return to Orange. We gave him his liberty. He descended to the kitchen, took his place with the others around the table, went out into the garden under surveillance of Aglaé, who did not allow him out of her sight, and made the circuit of the grounds with the most innocent air imaginable. Then he came back into the house. Victory! The cat was sure now not to run away.

“Next day: ‘Tawny, Tawny!’ No Tawny appeared. Oh, the hypocrite, the hypocrite! How he had deceived us! He had run away, he was back at Orange. But no one except myself would believe he had dared undertake such a journey. I maintained, however, that the deserter was at that very

moment in Orange, mewing before the closed house.

“Aglaré and Claire went to see for themselves, and they found the cat as I had predicted. They brought him back in a basket. His paws and stomach were crusted with red earth, although it was dry weather. Consequently he must have got wet in the waters of the Aigues, and then the red dust of the fields that he afterward crossed had stuck to his dripping fur. The distance in a straight line from Sérignan to Orange is about seven kilometers. The Aigues is spanned by two bridges, one above and the other below its intersection with this imaginary straight line, and a considerable distance apart. The cat had made use of neither of them; his instinct had told him the shortest way, and he had followed that course, as was proved by the red earth sticking to his stomach. He had swum the river in May, when the stream is at flood; he had conquered his dislike of water to return to his beloved home. Our tom-cat at Avignon had done the same in crossing the Sorgues.

“The deserter was once more shut up in the garret at Sérignan. He remained there two weeks and was then let out. Not twenty-four hours later he was back at Orange, and we were obliged to leave him to his wretched fate. A former neighbor of mine told me that he had one day seen the cat hiding behind a hedge, with a rabbit in his mouth. Having no more dainty food served to him, he, accustomed to all the luxuries of the feline pet, had turned poacher, exploring the farm-yards round about his former home. I have never heard any-

thing more of him. Having taken to a life of pillage and plunder, he must have ended his days as a pillager and plunderer.

“The thing had been proved; twice I had seen it proved: full-grown cats can find their way home in spite of distance and the entire strangeness of the region to be traversed. They have, after their fashion, the same homing instinct as my mason-bees.

“A second doubtful point remained to be cleared up, the matter of swinging the animal in a sack. Are cats made to lose their bearings by this operation, or are they not? I was planning some experiments to settle this question when more definite information reached me and convinced me that they were unnecessary. The first person to tell me about the sack method spoke on the authority of some one else, who had repeated the assertion of a third, who had learned the thing from a fourth, and so on in an endless series. No one had actually tried the method; no one had seen it tried; it was merely a tradition current in the country. All commended the process as infallible without having, for the most part, put it to the test. And the reason they gave for its unfailing success was, to them, convincing. If, they said, we bandage our eyes and turn around a few times, we entirely lose our bearings. So it is with the cat whirled about in a sack. They reasoned from man to animal just as others reason from animal to man, a faulty method in each instance if there are in very truth two distinct psychic worlds.

“Before such a belief as this could become so

firmly fixed in the peasant mind there must have been certain facts to give it some degree of credibility. But in any apparently successful applications of the sack method it is probable that the cats concerned were young and not yet inclined to assert themselves. With these novices a saucer of milk is enough to banish the sorrows of exile. They do not go back to the old home, no matter whether they have been swung in a sack or not. These animals may have been subjected to the sack treatment as a precaution, and the apparent effect of that treatment inspired faith in its infallibility, whereas the treatment produced no effect whatever. For a real test of the method one ought to operate on a full-grown male, a veteran tom-cat.

“On this point I at last obtained the testimony I was seeking. Certain persons worthy of confidence, reflective and able to disentangle one thing from another, informed me that they had tried the sack-swinging method to prevent cats’ returning home, but without success when the cat operated upon was full-grown. Carried to a great distance and released in new quarters after conscientious whirling in a sack, the animal always went back to its old home. I recall especially one cat with a great fondness for goldfish, these fish being kept in a basin which the animal persisted in plundering. After being carried from Sérignan to Piolenc, with faithful application of the sack treatment, the hardened sinner returned to his goldfish. Transported, in a second attempt to get rid of him, to the mountains and abandoned in the heart of a forest, the cat still

came back. Then, the revolving sack having proved to be without effect, the miscreant had to be killed.

“I have collected a sufficient number of similar instances, all duly authenticated, and their evidence is unanimous: swinging in a sack has no effect whatever in preventing a full-grown cat’s return to its home. The popular belief, at first so seductive to me, is nothing but a country tradition based on imperfectly observed facts. We must, then, reject Darwin’s suggested explanation of the return of mason-bees as well as of cats.”

Fabre’s writings contain frequent mention of his faithful dog Bull. One hot summer day, when the master was engaged in a prolonged study of certain insect habits out in the open field, the dog’s fidelity and devotion were put to a severe test. Fabre, with humor of a slightly bitter savor, describes his four-footed attendant’s behavior:

“Lying on the ground from the beginning to the end of the operation, which may have occupied several hours, I followed very closely every act of the insect, while my dog, severely tried by the furnace-like temperature, cunningly substituted his room for his company and, with tail depressed and tongue hanging out, slunk home to stretch himself on the cool flagstones of the vestibule. Ah, how sensible of him to hold in slight esteem this act of staring at a heap of stones! I returned home half roasted and as brown as a cricket; and there I found my comrade, his sides panting, his back in the angle made by two walls, his four paws stretched out flat, and his whole body still showing the effects of the

terrific heat to which it had been subjected. Ah, how much better advised than I Bull had shown himself in retiring as soon as possible to the shade of the house! Why is it that man is forever seeking after knowledge? Why does he not cultivate indifference to the causes of things, that utter indifference that constitute the dumb beast's high philosophy? Why should we concern ourselves with what does not fill the belly? Of what use is learning? Of what use is the true when the useful is sufficient? Why am I, the descendant of some prehistoric monkey, as I am told, afflicted with a thirst for knowledge, whereas Bull, my companion, is free from any such affliction? Why— But enough! Where was I? Is it possible my brain has been affected by the sun? Let us return without delay to the subject in hand."

Another incident of like character, in which long watching under a burning sun was the price paid for a precious bit of new knowledge, may be related here. The story must be told in the naturalist's own words, so far as another language can reproduce them.

"Ah, how long the hours are, passed in motionless silence under a scorching sun, at the foot of a steep bank that sends the heat as of an oven beating down upon the watcher! My inseparable companion, Bull, has retired into the shade some distance away, and is lying under a clump of evergreen oaks, where he finds a layer of sand deep enough to retain some traces of the latest shower. He digs himself a bed, and in this cool hollow the self-indulgent crea-

ture stretches himself flat on his stomach. With tongue hanging out and tail lashing the foliage, he looks at me fixedly out of the depths of his gentle eyes.

“ ‘What are you doing over there, you simpleton, roasting in the sun?’ I seem to read this question in my companion’s gaze. ‘Come over here into the shade. See how comfortable I am.’

“ ‘Oh, my dog, my friend,’ would be my reply if he could but understand, ‘man is tormented with a thirst for knowledge, while your torments go not beyond a hunger for bones and, occasionally, a desire for the female of your kind. This, despite our mutual attachment, constitutes a certain difference between us, although it is said nowadays that we are related to each other, almost cousins in fact. I have a thirst for knowledge, and am therefore willing to roast in the sun; you do not have any such thirst, and therefore you retire into the cool shade.’ ”

That Fabre studied dogs with something of the keen interest and close attention that marked his study of insects, was only natural in one to whom no creature of God’s universe was without its peculiar importance. Half a dozen chapters of his book on the domestic animals, a book known to English-speaking readers under the title of “Our Humble Helpers,” are devoted to that most faithful of man’s four-footed attendants, the dog. A few paragraphs showing something of the writer’s curious knowledge of his subject may be not out of place here. In the character of “Uncle Paul” he says:

“It would be hard to discover two dogs exactly alike. Were they of the same breed, the same shape and size, they would differ in coat, at least in some details. Three colors, red, white, and black, belong to the dog’s coat; sometimes one alone for the whole body, sometimes all mixed together, sometimes the three distributed in spots or in great splashes. If the coloring is varied, the spots are hardly ever arranged in order, but are scattered haphazard. There is lack of symmetry in their distribution; or, in other words, on the two halves of the body, the right and the left, the spots do not correspond. You might say the same of most domestic animals: you would nearly always note differences between two oxen, two horses, two goats, two cats, and would find that in the same animal both sides of the body are not exactly alike in the arrangement of the colors.

“It is just the reverse with wild animals: there is close resemblance between individuals of the same species, with symmetry of coloring on the two halves of the body. As one is, so are all, with very slight exceptions; and as is the right side, so is the left. Whoever has seen one wolf has seen all wolves; and whoever has seen from one side an animal with variegated coat has seen both sides. One of the most invariable effects, therefore, of domestication is the replacing of this primitive regularity in color by irregularity, this similarity in individuals by dissimilarity.

“The dog’s coat goes contrary to every rule of regularity except in one most curious respect: if the

animal is spotted with white, one of these white spots is always on the end of the tail. Examine a black dog, for example: if you see so much as one white speck on it, no matter where, on the flank or on the shoulder, you will be sure to see one where I told you. Look at the end of the tail and you will find at least a touch of white there."

Here Uncle Paul's nephew Jules breaks in:

"So it is enough to see some white on any part of a dog to be sure that it will have some also on the tip of its tail?"

"Certainly," is the answer, "unless, of course, the animal has had its tail docked, in which case I will not answer for it."

The story of "The Dog of Montargis," in the same volume, shows Fabre to have been a true lover of the most intelligent of man's four-footed companions.

CHAPTER XX

THE ODDITIES OF FAVIER

WHEN one man attempts to describe another, he to some extent describes himself. He can see only what he has eyes to see. He can understand and appreciate in another only those qualities that appeal to something of like character in himself.

This by way of preface to Fabre's enjoyable description of his honest and faithful but not intellectually brilliant old servant. In following the master's account of Favier and his ways we shall gain a better acquaintance with both the master and the man.

"One day in May," Fabre tells us, "I was rambling through my grounds to see what might be going on of importance in my laboratory of wild nature. Favier was not far away, at work in the vegetable garden. But who is Favier? I may as well say a few words about him before going farther, for he will reappear in my narrative more than once as I proceed.

"Favier is an old soldier. He has erected his hut under the carob-trees of Africa, he has eaten sea-urchins in Constantinople, and he has shot starlings in the Crimea during a pause in the rattle of

musketry. Having seen much, he has remembered much. In winter, when his out-door work for the day is done, at about four o'clock, and when the evenings are long, after putting away his rake and fork and wheelbarrow he comes in and sits on the high stone by the kitchen fireside where the logs of evergreen oak are blazing. He produces his pipe, methodically rams down the tobacco with his thumb, which he first moistens with saliva, and proceeds to smoke in all solemnity. For long hours he has been looking forward to this indulgence, but he has abstained until the appointed time, for tobacco is dear. Hence the zest with which he gives himself to this treat; not a puff of smoke is wasted, and the puffs are accurately timed.

“Meanwhile conversation has started. Favier is, in his own peculiar way, one of those ancient story-tellers who, by virtue of their story-telling gift, were accorded the best place at the fireside; but my story-teller learned his art in barracks. No matter; all the family, both old and young, listen to him gladly. If his language is vigorous, it is at the same time void of offense. It would be a keen disappointment to us if, after finishing his work, he did not come and join us at the fireside. What, then, does he tell us to make us so glad of his company? He tells us what he saw of that stroke of statecraft that gave us the abhorred Second Empire. He describes the serving out of brandy in little glasses and the subsequent firing into the mob. He himself, he asserts, always aimed at the wall, and I take his word for it, so distressed and ashamed does he appear of having

taken any part, even a very innocent one, in this piece of villainy.

“He tells us of his night watches in the trenches about Sebastopol, and of his panic when, one night, being all alone at one of the outposts, he saw fall at his side something that he calls a flower-pot. It was blazing, melting, flashing, lighting up the whole neighborhood. Every moment the infernal machine threatened to explode. Our good Favier thought his last hour had come. But that was all it amounted to: the blazing flower-pot subsided, and the flames died away as peacefully as you please. It was a flare thrown over by the enemy in an attempt to reconnoiter the opposing outworks.

“The tragedy of the battle-field is followed by the comedy of the barracks. He reveals to us the mysteries of the stew-pan, the secrets of the mess, the comical tribulations endured in the cells. And as his fund of anecdotes, flavored with pungent expressions, is never exhausted, it is supper-time before we are aware of it.

“My attention was first called to Favier by a master stroke on his part. One of my friends had just sent me from Marseilles a pair of enormous crabs, known to fishermen as sea-spiders, the more learned name being *maia*. I was unpacking the captives when the workmen returned from their dinner—painters, masons, and plasterers, engaged in renovating the house after its period of vacancy. At sight of these strange creatures studded with spikes all over their shells and perched on their long legs so that they looked rather like monstrous spiders,

a cry of astonishment, almost of alarm, went up from the onlookers. But Favier never turned a hair. Seizing with great dexterity one of the horrible spiders, despite its struggles, he said:

“ ‘I know this fellow; I ’ve eaten the mate to him at Varna, and it ’s rare eating, too.’ ”

“With that he surveyed the company with a mocking air, as if to add:

“ ‘Oh, you poor devils, you ’ve never once stirred out of your hole.’ ”

“Favier knows many things, and he knows them best when he has eaten of them. He knows the excellence of a badger’s back and the fine savor of a fox’s haunch; he can tell you the tenderest part of that eel of the underbrush, the adder; he has fried the spotted lizard in oil, and he has studied the best way of cooking locusts. I am amazed at all the incredible dishes he has prepared in the course of his wandering life.

“Nor am I less astonished at the sharpness of his eyes and the retentiveness of his memory. If I describe to him any plant whatever, no matter how commonplace and despicable a weed in his opinion, I am almost certain that if it is to be found anywhere in our woods and fields, he will bring it to me and will tell me where I can go and get it myself. Not even the smallest of botanical specimens can escape his search. To finish a work of mine on certain fungi of Vacluse, I take my magnifying-glass and go botanizing in the winter season, when the insects are all asleep. Whether the frost has hardened the ground or the rain has turned it into mud,

I take Favier from his work in the garden and we go tramping off through the woods. Rummaging about in the bushes, we both of us hunt for those microscopic vegetable organisms that dot with black points the twigs growing close to the ground. He calls the larger species 'gunpowder,' an apt designation already adopted by botanists. He swells with pride when it so happens that he finds more specimens than I, and if he hits upon a superb *rosellinia*, a mass of little black pimples wrapped in wine-colored down, he has to get out his pipe and have a smoke in honor of the event.

"Especially does he excel in a certain knack of ridding me of the inquisitive country folk whom I meet in my rambles. The peasant is all curiosity and as full of questions as a child; but his is not the innocent curiosity of the child, and his questions are in the nature of chaff. What he fails to understand he ridicules; and what could be more ridiculous than a gentleman looking through a glass at a fly caught with a gauze net, or at a bit of rotten wood picked up from the ground? But Favier knows how, with one well-chosen word, to stop the impertinent's mouth. On one occasion, as we were going slowly along, bent over and our eyes on the ground, looking for those ancient relics that abound on the southern side of the mountain [Ventoux], such as stone hatchets, fragments of black pottery, flint arrow-heads and lance-heads, some one came up from behind and asked Favier:

" 'What does your master do with those old gun-flints?'

“ ‘He makes them into cement for setting glass,’ replied the old soldier, solemnly and with finality.

“On another occasion I had just gathered a handful of rabbit dung on which my magnifying-glass had revealed the presence of certain cryptogams worthy of further examination, when we were intercepted by an inquisitive busybody who had seen me carefully wrap up my precious find in a piece of paper. He suspected me of being engaged in some sort of mysterious trade, for with country folk all things have to do in some way with money. In the eyes of this interloper I must be making a handsome income out of my bits of rabbit dung.

“ ‘What does your master do with that stuff?’ was the question whispered in Favier’s ear.

“ ‘He distils it and extracts the essence,’ came the answer, with splendid assurance.

“Silenced by this astonishing reply, the questioner took himself off.”

Our honest Favier, with all his native shrewdness and his wide and varied experience, had certain superstitions, certain mistaken notions about the living things around him, and not even the authority of his honored master could persuade him to abandon them. For him the bat was a rat with wings, the cuckoo a sparrow-hawk temporarily transformed and endowed with a peculiar cry, the slug a snail that had lost its shell, the night-jar an old toad that had grown feathers and wings and was addicted to the milking of goats. Favier was, in his way, a convinced evolutionist: one animal was developed from another, and the proof was as plain as day.

"See how much alike they are," he would say, in answer to all objections. The boldness of his theories would have made Darwin gasp.

A fuller account of the French popular belief in the wonderful change of cuckoo to sparrow-hawk and back again occurs in Fabre's "Animal Life in Field and Garden," in the twenty-sixth chapter. These crude notions in respect to many of our familiar birds and animals the naturalist is fond of introducing for the purpose of showing that, in his opinion at least, they are really no more absurd than some of the learned theories of the scientists. He would much prefer, as he more than once intimates, to err on the side of honest ignorance than commit himself to the unproved assertions of science.

Again and again Fabre warns us not to accept a theory that has not been proved by numberless examples—not to reason, as does Favier, and as does the child, from superficial resemblances. He shows us how much more important, and how much harder to detect, differences are than resemblances. Not all creatures that fly are necessarily birds, not all that crawl are necessarily snakes.

Before taking leave of Favier and his crude theories in natural history, let us note the striking resemblance between the old soldier and Uncle Paul's gardener, Jacques, in "The Story Book of Science." Indeed, it is obvious that Jacques is none other than Favier in disguise. A paragraph from the chapter on venomous insects in the book just mentioned will help to make this plain. Jules had found a large caterpillar on the potato vines in the garden, and he

had taken it up to examine it at close range, whereupon—

“Jacques, who was weeding the potatoes, knocked the sphinx caterpillar out of Jules’s hands and hastened to crush it under his big wooden shoe. ‘What you are doing is very dangerous,’ said the good Jacques. ‘Handling poisonous creatures—what a piece of recklessness! Do you see that green venom? Don’t get too close; the ugly thing is n’t quite dead yet, and it might throw some poison on you.’ The worthy man took the green entrails of the crushed worm for poison. Those entrails did not contain anything dangerous; they were green because they were swollen with the juice of the leaves that the poor thing had just eaten.”

This old soldier, with his curious notions and bluff manners, was as devoted to his master as was Darwin’s old servant to the sage of Down, and was less critical of those scientific researches that were beyond his comprehensions. He would never have allowed himself to make the pitying comment that is credited to Darwin’s servant who, after watching his master’s absorbing interest in earthworms, remarked how unfortunate it was that the old gentleman could not find some useful employment instead of spending his time looking at angleworms!

CHAPTER XXI

IN THE CAUSE OF TRUTH

THE secrets of insect life are revealed only to him who will pay the price. Fabre's patient endurance of bodily discomfort in the cause of truth is something admirable, even though we may not dignify that discomfort with the name of martyrdom. Long hours of continuous investigation under the fierce summer sun of southern France, stings and bites and poisonous contacts in the close study of irritable bees and scorpions and other quick-tempered little creatures—all were willingly endured in the hope of adding one chapter or one paragraph or even one line to the book of natural history and thus increasing our store of useful knowledge.

Readers of Fabre's elementary science series will recall that more than once Uncle Paul assures Jules or Emile, in answer to their inquiries, that no small part of our knowledge of animals and insects—referring perhaps to snakes and scorpions and other more or less terrifying creatures—has been gained at considerable personal risk and no little bodily suffering, by zealous investigators who have scorned danger in the interest of truth and have watched the effect of certain venoms on their own flesh with a keenness of interest that allowed no selfish considerations to stand in the way of the attainment of

valuable knowledge. Uncle Paul, who of course is the author himself, well knew whereof he spoke, as many a curiously interesting and sometimes delightfully amusing passage in the "Souvenirs" makes plain. His smarting fingers (*doigts endoloris*) teach him and us not a few interesting things; and the smart is all borne by him, while the interest and the entertainment are ours with no penalty to pay, no inflamed and itching members to nurse back to their normal condition.

In "The Story Book of Science" Uncle Paul, referring to the venom of a bee's sting, takes occasion to say:

"Scholars who have made a study of this curious question tell us of the following experiment, to make clear that it is really the venomous liquid introduced into the wound, and not the wound itself, that causes the pain. When one pricks oneself with a very fine needle, the hurt is slight and soon passes off. I am sure Claire is not much frightened when she pricks her finger in sewing."

"Oh, no," said she. "That is so very soon over, even if blood comes."

"Well, the prick of a needle, insignificant in itself, can cause sharp pains if the little wound is poisoned with the venom of the bee or the wasp. The scholars I am telling you about dip the point of the needle into the bee's pocket of venom, and with this point thus wet with the venomous liquid give themselves a slight sting. The pain is now sharp and of long duration, more so than if the insect itself had stung the experimenter. This increase of

pain is due to the fact that the comparatively large needle introduces into the wound more venom than could the bee's slender sting. You understand it now, I hope: it is the introduction of the venom into the wound that causes all the mischief."

"That is plain," said Jules. "But tell me, Uncle, why do those scholars amuse themselves by pricking themselves with needles dipped in the bee's venom? It is a queer amusement, hurting oneself for nothing."

"For nothing, Mr. Harum-scarum? Do you count as nothing what I have just told you? If I know it, must not others have taught me? Who are those others? They are the valiant investigators who learn about everything, observe and study everything, in order to lessen our suffering. When they voluntarily prick themselves with an envenomed needle, it is that they may study, in themselves and at their own risk and peril, the action of the venom, and then tell us how to combat its effects, which are sometimes so grave. Let a viper or a scorpion sting us, and our very life is in peril. Ah, then it is important to know exactly how the venom acts and what must be done to arrest its ravages; it is then that the scholar's researches are appreciated, researches that Jules looks upon as merely a queer amusement. Science, my little friend, has sacred enthusiasms that do not shrink from any test that may enlarge the sphere of our knowledge and diminish human suffering."

In "The Wonder Book of Chemistry" Uncle Paul has occasion to refer to the courage of balloonists

who, for the sake of adding to our knowledge of the upper atmosphere, ascend to great heights. "The most daring have gone up ten thousand meters," he says.

"Why not higher?" asks Jules. "I'd have gone a good deal higher if I'd been in their place. I should have wanted to see what there is at the very top of the blue sky. How beautiful it must be up there above the clouds!"

"In their place you would have done as they did, my dear boy, or probably not so much, for it takes almost superhuman courage to dare to visit those high regions. When you get to where there is not air enough, breathing becomes impossible and you have to come down in a hurry, or you are dead in a few minutes. That is why, up to the present time, the greatest height attained by man is about ten thousand meters."

In the course of his study of the homing instinct of mason-bees, of which some account has already been given, our naturalist was often obliged to handle the bees in order to mark them for future recognition. This treatment was, naturally enough, resented by the subjects and not without its painful consequences to the investigator. As Fabre well says,—

"It is no trifling matter to manipulate, one by one, with the finger-tips, forty irascible bees that are prompt in action with their stings, veritable poisoned darts. Before the insect can be marked the stiletto thrust is only too often given. In spite of myself my smarting fingers twitch and involun-

tarily try to save themselves. I grasp the bee with more precaution for myself than for the insect, and I sometimes press the little creatures harder than is good for them. It is a fine and noble thing, and one that calls for the facing of many dangers, to experiment for the sake of raising ever so slightly a very small corner of the veil that hides the truth; but at the same time it is permissible to show some little impatience when, within perhaps half an hour, the experimenter gets stung forty times on the ends of his fingers. If any one is inclined to blame me for some lack of delicacy in handling my bees, I would suggest his undertaking the operation himself; then he will learn from experience how far from agreeable the thing is."

A less painful investigation was that taken in hand for the sake of determining the extent of injury inflicted by the sting of the *reduvius*, a genus of winged bugs that prey on other small game. The European fly-bug belongs to this genus. Fabre writes:

"It is said, indeed, that the sting of the *reduvius* is painful. Wishing to test the matter in my own person, that I might speak with authority, I tried to get myself stung, but without success. Placed on my finger and teased, the insect refused to unsheath its weapon; and my frequent handling of these bugs without the use of nippers was equally void of result. It is on the authority of others, therefore, and not from personal experience, that I believe the sting of the *reduvius* to be serious."

Another passage from the "Souvenirs" will show

us the zealous naturalist braving the intense heat of the sun in the open fields for the sake of gleaning perchance one additional item in the history of some little-known insect. The time of year is midsummer, and the scene is laid in the stony waste of Sérignan. The narrative proceeds:

“Every morning toward nine o’clock, when the heat is beginning to be unbearable and, as Favier puts it, another log has been thrown on the fire in the sun, I take the field, resolved to submit to a sun-stroke if only I may succeed in obtaining the answer to my enigma. One must certainly be possessed by a veritable demon to forsake the shade at this season. And why, pray, do I do it? That I may write the history of a fly! The hotter the sun, the better my chances of success. What is torture to me is joy to the insect; what prostrates me stimulates the insect. But I must push on. The highway is of a dazzling whiteness, like a river of molten steel. From the olive-trees, gray with dust, there goes up a sonorous throbbing, a vast *andante* in which the performers are beyond counting. It is the cicadas’ concert, increasing in its frenzied shrillness as the temperature rises.”

The object of his search eluded the patient naturalist this time, but from no lack of vigilance and endurance on his part. He learned, however, that he was on the wrong track, which was something gained, at any rate. A more fruitful investigation, conducted by him with more satisfactory results and also with even more suffering to himself, was that in which he discovered why it is that the hairs from

certain caterpillars, notably the pine-tree processionary caterpillar, produce irritation on coming in contact with our skin. This effect is familiar to us in the stinging, smarting sensation caused by handling the caterpillar of the brown-tail moth, a rather recent importation from Europe. Do the barbed hairs of the insect, Fabre asked himself, act like the prickles of the nettle? Do they sting the flesh, injecting virus under the skin? Or are the caterpillar's hairs merely coated with an irritating substance from the body of the insect, a sort of poisonous wash that produces its effect upon coming in contact with our skin?

To decide this question it is necessary to give the hairs a thorough washing and then see whether their sting still causes irritation. If it does not, and if, on the other hand, the liquid used in washing the hairs is found to have the same irritating effect as that produced by handling the caterpillar, then we shall know that the insect's minute javelins are not conveyors of virus from within themselves, but are coated with it and merely leave it on our skin when we touch them.

Fabre tells us how he first became aware that the pine-tree caterpillar is not to be handled with impunity. He had been studying the creature closely through a magnifying-glass all one morning, with consequent itchings and burnings that lasted twenty-four hours.

"On seeing me come down to dinner in this pitiful condition," he writes, "with eyes red and swollen and face almost unrecognizable, my family

showed much concern, and asked what had happened to me. I had to tell them the story of my misadventure before they would be reassured." Then he adds: "No, it is not a very pleasant experience that the truth-seeker undergoes when he studies the back of a pine-tree caterpillar. It took a night's rest to restore me to something like my usual condition after this accident. But let us proceed nevertheless with our investigations. We must supplement accidental discoveries with prearranged experiments."

He proceeds on the supposition that caterpillar hairs are not containers of virus stored within and ejected at the barbed end, but are merely coated with it. This theory, however, had to be tested.

"If by means of a solvent," he says, "we remove this coating of virus, the darts of the caterpillar, acting now only mechanically, will be harmless, while on the other hand the solvent liquid, with all the hairs strained out, will contain the irritating substance, and it can be applied without the help of the hairs. Thus extracted and concentrated, the irritating principle, far from losing any of its strength, ought to gain in intensity. So at least it would seem upon reflection.

"The solvents tried by me are three in number: water, alcohol, and sulphuric ether. I employ the last named by preference, though the other two, alcohol especially, have given me satisfactory results. To simplify the investigation, instead of putting the whole caterpillar into the solvent liquid, which would give an extract charged with fat and

other products of the insect's body, I prefer to use the skin alone.

“Accordingly I gather together in one heap the dried skins sloughed off and left on the dome of the caterpillars' nest, and in another heap I collect the skins cast off in the cocoons just before the chrysalis stage. I set these two lots to steep, separately, for twenty-four hours in the sulphuric ether. The infusion is colorless. After careful filtering the liquid is left to evaporate in part, while the skins are washed in ether several times.

“Two tests are now to be made: one with the washed skins, the other with the liquid in which they were soaked. The first test is as conclusive as one could wish. Covered with hairs as in their normal state, and thoroughly dried, the skins of both lots produce not the slightest effect, though I rub them on my skin freely, at the knuckles, where the sensitiveness to nettles is greatest.

“The hairiness of the skins is the same as before the solvent was applied, the hairs having lost nothing in the way of barbed points; and still there is no effect produced. Of irritation there is not a trace. Rid of their virulent coating, these thousands of tiny darts are changed to harmless velvet. Our apple-tree caterpillar is not more inoffensive.

“The other test is far less negative in its nature; indeed, it is so vehemently affirmative in its painful effects that one would hardly care to repeat it. After the infusion has by natural evaporation been reduced to a few drops, I saturate with the liquid a piece of blotting-paper folded twice so as to form a

square of rather more than an inch each way. Too little confident of the strength of my concoction, I am generous with my poor skin and with the amount of liquid absorbed by the blotting-paper. I would advise any one wishing to repeat this experiment to be less lavish in these particulars. Finally, the piece of blotting-paper, a new kind of plaster, is applied to the inner side of the forearm, and a small sheet of rubber is placed over it to prevent its drying too soon. A bandage holds the whole in position.

“No results in the first ten hours, then a lively itching followed by a burning sensation so acute as to cost me the better part of a night’s sleep. The next day, after twenty-four hours of contact, the plaster is removed. A red spot, slightly swollen and very clearly defined, fills the square formerly covered by the blotting-paper.

“Smarting as if from a caustic, the skin is roughened so as to look like shagreen. Each of its tiny pustules weeps a tear of serum which hardens into something resembling gum arabic in color. This oozing continues for two days and more, after which the inflammation dies down; the pain, until then very sharp, subsides; and the epidermis dries up and falls off in small particles. All is over except the red spot, which remains for a long time still, so lasting in its effects is the extract of pine-tree caterpillar. Three weeks after the test that little square on my fore-arm is still of a pale violet color.

“Is there anything gained by thus branding oneself as with a red-hot iron? Yes. A tiny bit of

new truth is the balm applied to the wound, and it is a sovereign balm, that of truth. Soon it is destined to soothe sufferings far more severe.

“At present we learn through this painful test that the irritation caused by the pine-tree caterpillar does not come primarily from the insect’s hairs. In our test there was not a single hair, not one of those tiny darts; they were all strained out in the filtering process. We have left only a certain virulent substance extracted by the solvent, the ether. This irritating substance resembles somewhat that obtained from Spanish flies, or cantharides as they are also called—a substance that acts by simple contact. My square of saturated blotting-paper was a sort of blister-raiser that, instead of lifting the epidermis in one large blister, caused a great number of tiny pustules.

“The part played by the barbed hairs, hairs so small that the slightest puff of air scatters them abroad, is confined to that of carriers for conveying the irritating matter impregnating them to our hands and faces. Their barbed points hold them in place and thus allow the virus to act. It is probable, too, that in producing slight scratches, which would otherwise heal without being perceived, the barbed hairs facilitate the action of the irritating substance.

“Soon after one has handled pine-tree caterpillars the epidermis, if it is delicate, becomes swollen, red, and painful. Even though not immediate, the effect is prompt. On the other hand, with the extract obtained by using sulphuric ether it takes some time

to produce reddening and pain. Why is the effect thus delayed? Apparently the caterpillar's hairs make all the difference.

“The irritation caused by the caterpillar directly is by no means so intense as that produced by the concentrated extract. Never in my most annoying misadventures, whether with the caterpillars' silken nests or with the insects themselves, had I seen my epidermis covered with pustules or peeling off in scales. But on this occasion I had a real wound of a rather serious appearance. The aggravation is easily explained. I put about fifty skins to soak in sulphuric ether. Consequently the few drops of extract left after evaporation and used in saturating the square of blotting-paper represent fifty times the virulence of one caterpillar. My little blister-raiser was equal in strength to fifty caterpillars applied to that one spot. There is no doubt that if a far greater number of caterpillar skins were used in making the concentrated extract, the result would be a preparation of formidable strength. It is not impossible that medical science may some day put to good use this powerful extract, so different from the preparation known as cantharidin, which is obtained from Spanish flies.

“Now let us see whether there is any remedy that may relieve a little the irritation caused by the pine-tree caterpillar, no matter whether this irritation has been incurred by voluntary victims to a curiosity that exposes them to some intense itching, or by those who have accidentally come in contact with the insect. If it is a good thing to learn the

origin of an evil, it is a still better thing to know the remedy.

“One day when both my hands were suffering from prolonged investigation of a caterpillar nest, I applied with no effect whatever a number of lotions, such as alcohol, glycerin, oil, and soapsuds. It was of no use. Then I recalled a remedy employed by Réaumur to relieve irritation caused by oak-tree caterpillars. Without telling us how he happened to know of the strange specific, he says he rubbed the affected parts with parsley and was helped by it. He adds that probably the leaves of any other plant would have done as well.

“Here was a fine opportunity for me to take the matter up and investigate further. In a corner of my garden was some parsley, well grown and green—one couldn’t ask for better. What other plant should I use for the sake of comparison? I chose purslane, an uninvited guest of my vegetable garden. Fleshy and rather gummy, it is easily crushed and yields an agreeable ointment. I rubbed one hand with parsley and the other with purslane, using pressure enough in each instance to reduce the plant to a paste. The result is worth recording.

“With parsley the itching was somewhat allayed, it is true, but even in its milder form it persisted a long time and was annoying; but with purslane the irritation ceased almost immediately and the cure was permanent, so that I gave my hand no further attention. My purslane ointment has unquestionable merits, and I recommend it, but without any

loud advertisement, to all who may be suffering from contact with the pine-tree caterpillar. Foresters, in their warfare on caterpillars' nests, would find it a very soothing remedy for the itching they often have to endure.

"I have also obtained good results from tomato leaves and lettuce leaves, so that, without experimenting further, I am convinced with Réaumur that any tender and juicy plant would have a certain efficacy.

"As to the how and why of this remedy I confess my utter ignorance, just as I acknowledge that I fail to understand the manner in which the caterpillar virus acts. Molière's candidate for a degree in medicine explained the soporific properties of opium by saying: *Quia est in eo virtus dormitiva cujus est proprietas sensus assoupire*. (Because it has a certain sleep-producing quality calculated to lull the senses.) In the same manner let us say that the crushed plant allays the irritation because it has a certain soothing quality calculated to relieve the itching. The solemn absurdity of the explanation is more philosophic than it appears. What do we know about our remedies? What do we know about anything? We know effects, but we cannot get behind these to the ultimate causes.

"In my village and for some distance around it there is a popular belief that to relieve the pain caused by a bee's or a wasp's sting it is enough to rub the affected part with three kinds of plants. Take three kinds of plants, the first three you come

across, bunch them together, and apply by energetic friction. The recipe is never known to fail. Such is the popular belief.

"At first I thought this one of those absurd nostrums that have their origin in the imagination of country folk; but since I have tried it I am forced to admit that an apparently nonsensical prescription may sometimes contain a grain of truth. Rubbing with three kinds of plants does actually allay the irritation caused by a bee's or a wasp's sting. But I hasten to add that rubbing with one plant alone does just as much good. Thus the result is in accord with what we have now learned concerning the application of parsley and purslane to relieve the irritation caused by the pine-tree caterpillar.

"But why three plants when one is enough? Three is the favorite number in black magic; it smacks of sorcery, which by no means lessens the virtues of the ointment. All rural remedies partake more or less of the black art, and if the number three can be worked into them, so much the better."

The indefatigable truth-seeker desired still further information. Exactly what was it in the caterpillar that caused the experimenter so much suffering? Suspecting it to be uric acid, he collected some of the droppings left in their nest by the pine-tree caterpillars and put them to soak in sulphuric ether. With the extract thus obtained he made a plaster and applied it to his arm, as before. The result was neither tardy nor doubtful. The frightful ulcer produced by this heroic test nearly overcame the nurse who daily dressed the experimenter's arm.

And yet the determined seeker for new truth went on with his researches, testing different caterpillars and trying to gain a wide variety of information from which to deduce some general principle. Nor was the lesson thus learned without its immediate practical application. Workers in silkworm nurseries had long been familiar with the itching often experienced by those that take care of the worms. Henceforth they were warned by Fabre to beware of the dust and litter left by the insects in their nests. With proper precautions all trouble from this source could be avoided.

At the end of his series of painful experiments the self-sacrificing investigator makes the following interesting and characteristic confession:

“My friends reproached me for not using animals as subjects of experiment, recommending for example the guinea-pig, that martyr to the science of physiology. But I did not heed their reproaches. Animals are stoics; they say nothing about their sufferings, or if, tortured too severely, they utter a complaint, I cannot translate it and make sure just what it means. The animal will not tell me, ‘That itches,’ or ‘That burns,’ or ‘That eats into my flesh’; but it merely says, ‘That hurts.’ As I wish to know more exactly the sensation produced, the best thing for me to do is to operate on my own flesh, the only witness whose testimony I can fully trust.

“At the risk of being laughed at I will allow myself another confession. As I begin to see things in a clearer light, I feel scruples about torturing or

killing any creature in the great city of God. The life of the least of living beings is something to be respected. We can take life, but we cannot give it. Peace to those innocent ones so little concerned with our investigations! What is our restless curiosity to their calm and sacred ignorance? If we must seek knowledge, let us pay for it in our own persons as far as possible. A new discovery is well worth the sacrifice of a bit of human skin."

There we have the kindly, lovable quality of our tender-hearted naturalist.

CHAPTER XXII

THE CRUELITIES OF SCIENCE

ONE of Fabre's chief contributions to the science of entomology has to do with the manner in which certain insects, such as the digger-wasp and the sand-wasp, provide for their young a supply of what might be called fresh meat that will keep until it is all eaten up by the growing larva. The victim is paralyzed by a cunning application of venom at one or more nerve-centers, and the instinctively expert larva spares the vital parts until very near the end of its repast, so that there is a continuous supply of living and not dead flesh as long as the consumer requires it.

Although Fabre's kind heart and sensitive nature were revolted by the cruelties of vivisection, he did now and then practise something not unlike it, in his eagerness to learn all that could be learned about his "beloved insects." Probably these experiments of his on living creatures of a low order in the scale of animal life were not so excruciatingly painful as a high-strung human observer might sympathetically imagine. At any rate, it was always the experimenter's endeavor to inflict as little suffering as possible. In demonstrating to Jules and Emile the suffocating character of nitrogen Uncle Paul, in

"The Wonder Book of Chemistry," places a sparrow in a bell-jar filled with the gas, and the rather distressful end of the bird is watched with painful interest. But suitable comment is made by the kind-hearted instructor on the regrettable character of all such investigations, even when they are prompted by the highest possible motives.

"This experiment," Uncle Paul confessed, "is one that I have no liking for; nor does it please you any better, my dear children. The sight of a creature in pain, suffering as the victim of our curiosity, like this sparrow dying to afford us instruction, is as repugnant to your kindly nature as it is to mine. It is a thing to see once, the pursuit of knowledge having its cruel necessities; but it is not to be repeated."

After our entomologist had, by long and careful watching, fathomed the mystery of the motionless but not dead worm or other prey furnished to its young by the sand-wasp and by certain other insects, he could not rest content until he himself had tried by artificial means to induce the same paralysis. In his account of the matter he says:

"Instructed lately by the bees and wasps that paralyze their victims, I had myself tried to bring about paralysis by injecting a tiny drop of ammonia into the thorax of certain insects, such as weevils and beetles, which have a nerve-center adapted to this treatment. The pupil seems to have learned his lesson well from his teachers. At any rate, I paralyzed a beetle and a weevil almost as well as it is done in the way of nature. Why, I asked my-

self, should I not now emulate that expert assassin the tarantula? With the point of a fine needle I inserted a minute drop of ammonia at the base of the brain of a carpenter-bee, and repeated the operation with a grasshopper. Immediately the insect succumbed with no other movement than a series of convulsions. Attacked by the pungent liquid, the nerve-centers of the brain ceased their activities, and death followed. But it was not a sudden death, the convulsions lasting some time. If the experiment leaves something to be desired in the way of instant and final effect, what can be the reason? It must be that the liquid used, the ammonia, cannot be compared for effectiveness with the venom of the tarantula, a venom of terrible strength, as we shall see.

“I caused a tarantula to bite the leg of a young sparrow, full fledged and about to leave the nest. A drop of blood was shed, and the point attacked was encircled with a reddish ring that turned to violet. Almost immediately the bird lost the use of its leg, which dragged on the ground with claws curled up. But the victim hopped on the other leg and appeared not to mind its injury very much. It had a good appetite, and my daughters fed it with flies, bread crumbs, and the pulp of apricots. It would recover, it would regain its strength, and then the poor victim of a scientist’s curiosity would have its freedom restored to it—such was our desire and our purpose.

“Twelve hours later our hopes of the patient’s recovery became even brighter; the sparrow took

food very willingly and even clamored for it if there was any undue delay in offering it. But the wounded leg still dragged. However, I believed it to be a case of temporary paralysis that would soon pass. But on the second day after the experiment food was refused. Wrapping itself in its stoicism and its ruffled feathers, the little bird assumed the shape of a ball, now perfectly motionless, and now shaken with convulsive starts. My daughters took it up and warmed it in the hollow of the hand with their breath; but the convulsions became more frequent, and finally a last gasp announced that all was over. The bird was dead.

“At the evening meal there was a certain coldness perceptible. I read in the looks of the family a mute reproach and was conscious of a vague accusation of cruelty. The death of the poor sparrow had cast a gloom over the household. As for myself, I was not without some prickings of conscience; the smallness of the result attained seemed to me too dearly bought. Of a very different constitution from mine are those who, without moving a muscle, and in the pursuit of some very unimportant end, lay open the stomach of a live dog.

“Nevertheless I mustered up courage to repeat the experiment, this time on a mole that had been caught in the act of ravaging my lettuce bed. There was reason to fear that the ravenous appetite of my prisoner would complicate matters, for he might die, not of the wound he was to receive, but from lack of suitable and sufficient food served with suf-

ficient frequency. I thus ran the risk of ascribing to the venom injected what might be simply the result of starvation. Accordingly I had to find out first whether it was possible to keep the mole alive in captivity. Placed in the bottom of a large container whence he could not escape, the animal received for food various insects, especially beetles and grasshoppers and cicadas, which were devoured with evident relish. Twenty-four hours of this diet convinced me that my mole was satisfied with its bill of fare and was not fretting over its captivity.

“I caused it to be bitten on the end of its snout by a tarantula. Replaced in its cage, the animal took to rubbing its snout repeatedly with its large paws. Evidently there was an itching, smarting sensation at that point. Thenceforth the supply of insects was less and less partaken of, and on the evening of the second day food was refused altogether. About thirty-six hours after being bitten the mole died in the night, certainly not from any lack of nourishment, for there still remained in the cage half a dozen live cicadas and a number of beetles.

“Thus it was proved that the bite of the black-bellied tarantula is dangerous to other forms of animal life besides insects, being fatal to the sparrow and the mole. How far is it safe to go here in framing a general rule? I do not know; my investigations ended at this point. But it seems to me from what little I have observed that the bite of this spider would prove to be no trifling matter

in case a human being were the victim. That is all the contribution I can make to medical science under this head."

Another incident, even more swiftly and grimly tragic in its issue, may find its appropriate place here. Our naturalist was interested in studying the habits of the oak-tree bombyx. This insect, let it be said in explanation, belongs to the same genus as the bombyx of the mulberry-tree, which in its larval state is the familiar silkworm. The species engaging the attention of Fabre was exceedingly rare in his neighborhood, and it was only after long search and with the help of younger eyes than his own that a specimen was finally obtained. This he placed for the moment under a wire-gauze dish cover to await further examination.

"Late in the evening," he says, "there was brought to me a praying-mantis well worthy of my attention because of its peculiar appearance. Pre-occupied with the events of the afternoon, in a moment of absent-mindedness I hastily shoved the carnivorous insect under the wire-gauze dish cover that guarded my bombyx. It did not for a moment occur to me that this companionship might have evil consequences, the mantis was so slender and the other so corpulent. Hence there was no apprehension on my part.

"Ah, how little did I know the bloodthirsty fury of the grapnel-armed insect! A grievous surprise awaited me the next morning, when I found the little mantis devouring the enormous moth. The head and the fore part of the breast had already disap-

peared. Horrid creature, what a wretched half-minute you caused me! Farewell to my interesting studies, cherished in fancy all through the night! For three years they were not to be resumed, for lack of a subject."

The story of how the coveted bombyx, destined for so untimely and terrible an end, came into the naturalist's possession must not be omitted. It will serve, after the foregoing scenes of horror, to dispel the gloom and to illustrate the genial kindness and the fondness for children that lent so much of loveliness to Fabre's character. All the young people of his neighborhood must have been attracted by the simplicity and the genuineness of his nature and by his humorous sympathy with them in the tremendously important trifles that meant so much in their eyes. And the children on their part were eager to please the whimsical lover of bugs and worms by bringing to him any rare or curious specimen that seemed worthy of his notice or that he had perhaps described to them with promises of a rich reward for the capture of a specimen. This reward took the form of sugar-plums, pennies, a ride on the village merry-go-round, or admission to the wonders of the naturalist's menagerie of small creatures. Now, as to the long-coveted oak-tree moth, the bombyx whose short and sad history has just been related: the specimen was found by a ragged urchin of the neighborhood, and the account of the incident shall be told by the delighted purchaser of this rare treasure.

"Yes, I am going to have it; in fact I already

have it. An urchin of seven years with a wide-awake countenance that does not get washed every day, with bare feet and with ragged breeches held up by a string—this urchin, known to the household as a purveyor of turnips and tomatoes, comes to me one morning with his basket of vegetables. After receiving, as they are counted one by one, into the hollow of his hand, the few sous expected by his mother in payment for her garden produce, he draws from his pocket something found the day before beside a hedge, when he was gathering green stuff for his rabbits.

“‘And how about this?’ he asks, offering me the thing. ‘Will you have it?’

“‘Certainly I will have it. Try to find me some more, just as many as you can, and next Sunday you shall have a good ride on the wooden horses. Meanwhile, my little friend, here are two sous for you. For fear of a mistake in making up your accounts, don’t mix them with your turnip money; keep them separate.’

“‘Beaming with satisfaction at the possession of such riches, my little tousled-pate promises to make a good hunt, already foreseeing a fortune as his reward.

“‘After his departure I examine the thing, and it is well worth the trouble. It is a fine cocoon with blunt ends and resembles pretty closely the cocoons of our silkworm nurseries, being firm to the touch and of a tawny hue. Sundry items of meager information gleaned from books make me almost certain that it can be no other than the oak-tree bom-

byx. If it really should prove to be that, what a godsend! I should then be able to continue my researches and perhaps carry to completion the work I began in connection with the great peacock butterfly."

The upsetting of these cherished plans through his own unwonted carelessness we have already witnessed.

CHAPTER XXIII

WHIMSICAL EXPERIMENTS

IN his earliest infancy man seeks to enlarge his knowledge of the world about him through the sense of taste. Everything new and strange goes into his mouth if the object can by not too painful an effort be thrust into that accommodating cavity. This familiar trick of the normal baby we find rather amusingly imitated by the gray-haired entomologist of Sérignan. Desiring to extend his acquaintance with things eatable by man, Fabre undertook, on two somewhat memorable occasions, to test the nutritive value of certain small creatures not at present included in our bill of fare. His humorous way of telling the story, which he prefaces and amplifies with learned quotations, makes it well worth reading. First he quotes from General Daumas's book "The Great Desert," explaining in a foot-note that the grasshopper (*sauterelle*) referred to is "more exactly the cricket, which must not be confused with the true grasshopper":

"The grasshopper is good eating for both men and camels. Either fresh or pickled, it is eaten after the feet, wings, and head have been removed, the remainder being broiled or else stewed and served up in the form of meat-balls.

"After being dried in the sun it is ground to

powder, which may be stirred into milk or made into dough and then fried in fat or butter, with salt.

“Camels are very fond of grasshoppers, which are served to them either dried or roasted in a heap in a large hole between two layers of live coals. The negroes also eat them that way.

“The Virgin Mary having asked God for some meat that should have no blood, He sent her some grasshoppers.

“The wives of the prophets, when any one sent them a present of grasshoppers, always shared them with the other women.

“The Calif Omar, one day when he was asked whether the use of grasshoppers for food was permitted, replied: ‘I should like to have a basketful of them to eat.’

“From all this testimony it is clearly evident that by the grace of God grasshoppers were given to man for food.”

Fabre then continues on his own account:

“Without going as far as the Arabian naturalist, which would presuppose a robustness of stomach not given to all, I yet feel myself justified in saying that the cricket is a heaven-sent gift for a multitude of birds, as is testified by the long series of gizzards I have examined.”

As not a few insect-eating birds are held in high esteem by us for their food value, the cricket contributes in a roundabout way to man’s sustenance. Fresh-water fish, too, when the agile cricket, in one of its aimless leaps, lands unexpectedly in the water (let the Hibernicism stand to denote the long-

jumper's probable surprise), snap up the savory morsel and swallow it with evident relish. Then, when one of these fish is caught with a hook baited perhaps with a cricket, there is a contribution to human food supplies in which, once more, the toothsome insect plays an important part. In such wise, more or less whimsically and more or less seriously, the French naturalist calls attention to the debt we owe to the cricket.

But he wished to test more directly and more conclusively the nutritive qualities of the "acridians"—the reader will pardon this introduction of Fabre's own learned term for the family of "saltatorial orthopterous insects," the grasshopper and locust and cricket tribe. For, he argued, if the partridge and the wild turkey and dozens of other insectivorous birds are universally commended for their excellent flavor, why should we reject the small game that has gone to the fattening of this larger game? "Is it, then, so unappetizing?" he asks. "Such was not the opinion of Omar, the powerful calif, the brutal burner of the Alexandrian Library. With a stomach to match his intellect in rude vigor, he could make a feast, it was said, on a basket of locusts." John the Baptist, with his locusts and wild honey, is then cited, and the naturalist declares that he himself has sampled both the wild honey and the locusts, "otherwise called crickets." The mason-bee's cell furnished him the honey, and he pronounces it "very acceptable." As to the cricket, he continues, "In my boyhood I have, like many an-

other youngster, chewed and enjoyed the haunch of this insect. It is not without savor. Now let us go a step farther: let us try the dish of Omar and of John the Baptist."

So said, so done. "I caught some large crickets," he goes on to tell us, "and they were cooked in simple fashion, being fried in butter and salted, just as the Arabian writer tells us to cook them. At dinner this strange dish was shared by all, both big and little, and the calif's feast was passed upon not unfavorably. It was far superior to the cicadas commended by Aristotle. It has a certain flavor of crawfish, an aroma of grilled crabs, and were it not that there is a good deal of leathery outside for so little edible inside, I would even go so far as to pronounce it good—but with no desire to try it again." Nevertheless, he takes pains to add, as if unwilling to leave the impression of having cast a slur on one of his beloved insects, our delicacy of stomach does not detract in the least from the merits of the cricket, that tiny ruminant of our greensward which plays so important a part in nature's laboratory where the world's food supply is prepared.

Another adventure in strange feasting is described at length in the tenth volume of the "Souvenirs." Any reader, young or old, who has an excessively queasy stomach is advised to omit the remainder of this chapter, even at the cost of missing some passages in Fabre's most delightfully whimsical vein. Those who have the hardihood to perse-

vere to the end will gain some fresh glimpses of our many-sided and always genially human entomologist.

“To-day is Shrove Tuesday, reminiscent of the ancient Saturnalia,” he writes. This mirthful and boisterous festival of ancient Rome in honor of the god Saturn was held in December. Fabre merely draws a comparison between the rollicking character of this pagan celebration and the similar unrestraint of the modern carnival which ends with Shrove Tuesday. He continues: “I am planning for this occasion an incredibly absurd dish that would have tickled the palates of the Roman epicures; and I wish my folly to have witnesses and sharers who, each after his own fashion, shall be able to appreciate the merits of an unfamiliar dish that no one except the learned has ever heard of. The merits of this rare treat are to be discussed in solemn council.

“We shall be eight at table: first, the members of my family, and then two friends, probably the only persons in the village before whom I could allow myself such an eccentricity without risk of being adjudged insane. One of these friends is the schoolmaster. Since he permits it and is indifferent to any foolish jeers that might be aimed at him if our banquet should ever become known, I will call him by his name, Jullian. Large-minded and fed on science, he has an intelligence open to all truth. The other, Marius Guigue, is a blind man who, cabinet-maker by trade, handles saw and plane in the complete darkness of his affliction with the sureness

of hand shown by the skilled workman of unimpaired vision. He lost his sight in youth, after knowing the joys of light and the wonders of color. But in compensation for the perpetual darkness to which he is doomed he has acquired for himself a gentle philosophy that is never other than cheerful, an ardent desire to fill, as far as possible, the gaps in his meager primary-school education, a sensitiveness of hearing that can appreciate the nicest shades of tone in music, and a fineness of touch truly extraordinary in fingers made callous by shop work. In our talks, if he requires instructions as to this or that geometrical property, he holds out his open palm to me. It is our blackboard upon which, with the tip of my forefinger, I trace the figure to be constructed, briefly explaining the matter as I lightly touch his palm. That is enough; he grasps the idea, and saw and plane and lathe will translate it into material form.

“On Sunday afternoons, especially in winter, when three blazing logs in the fireplace offer a delightful contrast to the wild fury of the northwest wind, the three of us assemble at my house. We constitute the Athenæum of the village, the rural Institute, where all things under heaven are discussed except politics. Philosophy, ethics, literature, philology, natural science, history, numismatics, archæology—any or all of these, as the unforeseen turns of conversation may prompt, furnish food for our interchange of ideas. It was at one of these reunions, the delight of my solitude, that to-day’s dinner was talked over and planned. Our

extraordinary dish is to be the *cossus*, a dainty held in high favor in ancient times.

“When the Romans had devoured other nations to the point of satiety, brutalized by excess of luxury, they began to devour worms. Pliny tells us that ‘the Romans carried the pleasures of the table to such an excess that they esteemed as a delicacy the large oak-tree worm known as the *cossus*.’

“Just what is this worm? The Latin naturalist is not very explicit; all he tells us is that it inhabits the trunk of the oak. No matter; with this much to go upon we cannot make a mistake. We have to do with the larva of the great capricorn beetle. A frequent occupant of the oak, this larva is noted for its corpulence; it looks like a plump white sausage.”

At this point the French naturalist examines critically the text of the Latin naturalist and finds reason to make the word *cossus* more general in its application than it at first appeared to be. He then proceeds:

“Let us not take in too narrow a sense the tree named in the Latin text. Interpreting freely the author’s words, we shall find other worms not less worthy of the designation *cossus* than that of the oak, as, for example, that of the chestnut-tree, the larva of the stag-horn beetle. But there is one indispensable requirement that must be met: the worm must be rather plump, well formed, and not repulsive in appearance. In addition to the larva of the capricorn beetle and that of the stag-horn beetle, both of which writers have identified with the fa-

mous worm of Pliny, I know of another that in my opinion would even better fulfil the given conditions. Let me relate how I happened to make this discovery.

“The law in its blindness leaves unpunished the good-for-nothing who, for the sake of a handful of crowns, plunders our majestic forests, disfigures the landscape, dries up the clouds, and turns the soil into a barren expanse of slag panting with thirst. In my neighborhood there used to be a superb grove of pines, the delight of blackbird, jay, thrush, and other frequenters of its shade, I myself being not the least assiduous in my attendance. The owner had this grove cut down. Two or three years after the massacre I visited the spot. The pines had all disappeared, having been converted into fire-wood and building-timber, and there remained only the enormous stumps, which were too deeply rooted for removal. They were left to rot where they stood. In these relics of the forest, already much injured by the weather, there were extensive tunnels and galleries, indicative of a vigorous population finishing the work of destruction begun by man. It remained to find out what sort of a population was swarming there. The owner had exploited his pine grove; he left me to exploit my idea, in which he took no interest.

“One fine winter afternoon, with all my family present and my son Paul wielding a strong cutting-implement, I set about disemboweling a couple of these stumps. Hard and dry outside, the wood changed within to very flexible layers like sheets

of tinder. In the midst of this warm and moist decay there was found in abundance a worm about as large as one's thumb. Never had I seen worms so fat. They were pleasing to look at in their ivory whiteness, and soft to touch in their satin smoothness. To a person free from prejudice in matters of diet they were even of appetizing aspect in their resemblance to translucent sausages fairly bursting with fresh butter. At sight of them the thought came to me that here was the *cozzus*, the real *cozzus*, far superior to the larva of the capricorn beetle. Why not try the much-vaunted dish? It was a fine opportunity, one that might never occur again.

"Accordingly an ample supply was collected—in the first place, that I might study the worm, its shape indicating to me that it belonged to the family of longhorns, and, in the second place, that I might solve the culinary problem stated above. It behooved us to find out precisely what insect Pliny had in mind, and we also wished to acquaint ourselves with the flavor of the *cozzus*. It is now Shrove Tuesday, and the hour is propitious for this gastronomic folly.

"I know not with what sauce this delicacy was eaten in the time of the Cæsars, the cook-books of the period giving us no information on that point. Ortolans are roasted on a spit, and it would be a profanation to flavor them with elaborate sauces. Let us proceed in the same manner with the *cozzus*, the ortolan of the insect world. Side by side on skewers, they are exposed to the heat of glowing coals. A pinch of salt, that indispensable condi-

ment, is all that is added. The roast takes on a golden brown, shrivels up a little, and a few drops of oil ooze out, taking fire when they fall upon the coals and burning with a beautiful white flame. Our roast is done to a turn and must be served hot.

“Encouraged by my example, the members of the household bravely attack their helpings. The schoolmaster hesitates, yielding to his imagination, which sees the fat worms of a few minutes ago crawling about on his plate. He chooses the smallest pieces as less disturbingly suggestive. The blind cabinet-maker, not so easily affected by imaginary loathings, musters up his courage and tastes of the dish, with every appearance of satisfaction.

“The testimony is unanimous: the roast is juicy, tender, and very savory. We detect in it a certain flavor of burnt almonds with a slight aroma of vanilla. In short, the new dish is found to be acceptable, one might even say excellent. And when prepared with the refined art of the ancient epicures, who shall say what a dainty it may not have been?

“The skin alone leaves something to be desired, being rather tough and leathery. It is as if we had offered to us a fine sausage encased in parchment; the contents we find delicious, the container is too much for our powers of mastication. I offer it to my cat and, much as she likes sausage skins, she refuses it. My two dogs, assiduous attendants at the dinner table, also decline the offering, and with decision, certainly not because of its toughness, for their gluttonous tastes are supremely indifferent to questions of digestibility. Their subtle sense of

smell tells them that the proffered morsel is something strange, something absolutely unknown to their race; and so, distrustful, after a mere sniff, they draw back as if I had offered them a bit of bread coated with mustard. It is too new for them.

“They call to my mind the open-mouthed astonishment of the women of my village when, one market day at Orange, they were walking along inspecting the wares of the fishwives. There were baskets of shell-fish, lobsters, and sea-urchins. ‘Look there!’ they exclaimed, pointing at the sea-urchins. ‘Do people really eat those things? And how are they cooked—boiled or roasted? You could n’t hire me to touch the nasty things.’ And with that, greatly marveling that any one could bring himself to bite into such horrible creatures, they turned their backs on the unpleasing sight. So it was with my cat and my two dogs; for them as for us an unaccustomed dish is something one must learn to like.”

Then follow several paragraphs of curious interest to the Latin scholar who is at the same time something of an entomologist. They illustrate Fabre’s many-sidedness, his interest in all things likely to appeal to an open and alert mind, his surprising breadth of culture. Like Terence, with whom he was undoubtedly on friendly terms, he found nothing human alien to him.

“Enough on the subject of the *cossus* and my crazy experiment with it,” he concludes. “When I entered upon this investigation, it was certainly not in the hope of enriching our culinary art. No, that was not my object, although Brillat-Savarin main-

tained that 'the invention of a new dish is of more importance to mankind than the discovery of an asteroid.' The scarcity of the great worm that lives in the pine stump, the repugnance inspired in the immense majority of us by all vermin, would always stand in the way of any general acceptance of this new dish of mine. Probably it will remain a thing merely of curious interest, its merits accepted on faith and with no desire to test them. Not every one's stomach is independent enough to appreciate the fine points of a worm as an article of food.

"For my part, I was little tempted by the lure of a delicious mouthful. My abstemiousness does not easily yield to temptation. A handful of cherries suits me better than any of our refinements of cookery. My sole purpose was to clear up an obscure point in natural history. Did I succeed? Perhaps."

Here may fitly be quoted the naturalist's praise of that humble vegetable, the bean. The passage offers further evidence of the writer's simple tastes and abstemious habits. This is what he tells us:

"If there is anywhere to be found on this earth a legume bestowed by heaven, it is the bean. It has many virtues—softness of substance, an agreeable flavor, great productivity, cheapness, and much nutritive value. It is vegetable meat, with nothing offensive about it, no sickening flow of blood; and yet it equals in nourishment the repulsive objects we see cut up on the butcher's block. . . . Sacred bean, solace of the poor and costing little, you satisfy the hunger of the worker, the worthy man of native

ability to whom no lucky number has fallen in the stupid lottery of life. Refreshing bean, with three drops of oil and just a flavoring of vinegar, you were a feast to me in my youth, and now likewise, toward the end of my days, you are welcome in my poor porringer. Let us continue to be friends to the very last."

Fabre's reference to his simple tastes is no exaggeration. An apple and a crust of bread would suffice him for a long day's tramp in the pursuit of some coveted insect or plant. Like an athlete in perfect condition, he was trained down to the minimum of "excess baggage," of disfiguring and encumbering fat, both physically and mentally. His portraits show this in a striking manner.

CHAPTER XXIV

DO INSECTS REASON?

FABRE, greatly though he admired and respected Darwin, could not bring himself to accept the English scientist's explanation of the origin of species. He was content to be counted an opponent of the theory of evolution, so generally accepted in his later years. He could not believe that differences of animal structure are determined by blind chance, by any influence of environment, by any struggle for existence; nor could he conceive of reason, intelligence, which he held to be man's peculiar gift, as having been gradually developed in animal life as we ascend from the lower to the higher orders. All such explanations of the wonders of creation were to him as unconvincing as would have been an attempt to account for Homer's "Iliad" by saying that the letters of the Greek alphabet, in sufficient quantities and in right proportions, had been tossed into the air and had fallen in the order and the metrical arrangement now found in the poem.

To the Divine Will and Wisdom alone he ascribed the infinite variety of animal and plant forms. Just as the poet Young was moved to assert that "the undevout astronomer is mad," so Fabre saw in the insect world (to go no farther) abundant evidence

to convince him that the undevout naturalist is mad. When a friend once asked him whether he believed in God, he answered: "I do not *believe* in God, because I *see* him in all things and everywhere." Animal instinct, and more especially the marvelous instinct shown by insects, filled him with wonder and reverential awe. To the Power that made the animals and the insects he ascribed the gift of unreasoning instinct with which they are endowed, and any attempt to find even the beginnings of conscious reason in this wonderful gift he regarded as foolishness.

Bearing in mind this firm conviction of his, a conviction arrived at only after long and careful research and deep study, we shall be in a position to follow with intelligence and enjoyment his series of entertaining experiments with the processionary caterpillar of the pine-tree; and we cannot do better than to read his own story of those experiments, even though it has seen the light in more than one form since its first publication in French.

"The sheep of the drover Dindenaut," Fabre writes, "followed one of their flock that Panurge had mischievously thrown into the sea; in quick succession they all jumped in after the involuntary diver, for, says Rabelais, 'it is the nature of the sheep, the stupidest creature in the world, to follow its leader always whithersoever that leader may go.' The pine-tree caterpillar, not from stupidity but from necessity, is even more sheep-like than the sheep: the way taken by the first all the others take,

in single file, with no interval between one caterpillar and the next.

“Thus they move in single file, in one continuous line, the head of each touching the rear extremity of its predecessor. Whatever twists and turns the file-leader chooses to indulge in, all the others follow suit with scrupulous exactness. The solemn processions at Eleusis did not exhibit more perfectly concerted action. Hence the name ‘processionary’ given to the insect that lives on pine-needles. To complete this description, let it be added that the caterpillar in question is a rope-walker all its life: it walks only on a stretched cord, on a rail of silk that is laid down as it advances. The leader of the procession—a position determined by mere chance—is continually discharging its silken thread and attaching it to the path that the whim of the moment prompts it to follow. This silken thread is so fine that even with a magnifying-glass one rather suspects it to be there than actually sees it.

“But the second caterpillar, walking over this slender footbridge, adds its thread to it; the third does likewise, and so on to the end of the line, each processionary sticking the product of its spinnerets to the common rope, so that when the entire procession has passed there is left in its track a broad ribbon whose shining whiteness glistens in the sun. By this system of road-making, far exceeding ours in luxury, a carpet of silk instead of macadam is laid down. We spread crushed stone on our highways and then even off the surface with steam

rollers; they lay down a soft satin ribbon, in the making of which each individual contributes a thread.

“Why all this luxury? Could n’t they, like other caterpillars, travel over a less sumptuous road? For their method of advance I see two reasons. It is night-time when the processionaries go forth to feed on the pine-needles. In deep darkness they issue from the nest situated at the end of a branch; they descend along the bark already stripped bare until they reach the nearest branch not yet attacked; and they have to go lower and lower as these foraging expeditions continue. Ascending the branch to be fed upon, they disperse among the green pine-needles.

“After they have finished feeding, and when the chill of the night air has become uncomfortable, the question of getting back to the home nest presents itself. In a straight line the distance is not great, perhaps only a few feet; but foot passengers cannot take this direct line. They are obliged to creep down from pine-needle to twig, from twig to branch, and so on until they reach the main road, by which they must climb, in an equally tortuous course it may be, to their domicile. To guide them over this long and devious path they cannot depend on their eyesight. It is true that the processionary has, on each side of its head, five points representing organs of vision, but so very minute, so difficult to make out even under a magnifying-glass, that we cannot ascribe to them any far-reaching power of sight. Besides, of what use would their eyes be

to them in the absence of light, in the darkness of night?

“Nor can any sense of smell guide them. Has the processionary caterpillar, or has it not, any such sense? I do not know. Without attempting to answer this question, I can at least assert that its sense of smell is of the dullest sort and by no means keen enough to serve as a pathfinder. This is proved by experiments of mine in which a number of caterpillars, after being subjected to a long fast, passed very near a pine branch without showing the least inclination to halt and eat. It is touch alone that they depend upon in their movements. Until their pasturage is by some lucky chance touched with the lips they do not begin to browse, no matter how hungry they may be. The odor of food does not draw them; they merely settle down on the needle-covered branch met with as they advance.

“Sight and hearing being thus barred out, what is there left to guide them on their return to their nest? The cord or ribbon spun on their outward journey. In the Cretan labyrinth Theseus would have been lost without the ball of thread given to him by Ariadne. The vast jungle of pine-needles, especially at night, is a labyrinth as bewildering as that of Minos; but with its pathway of silk as a guide the processionary retraces its steps in no fear of going astray. When the moment arrives for returning, each caterpillar easily finds either its own thread or that of one of its companions, all the threads radiating fanwise from the main path; and thus, one by one, the scattered members of the com-

pany reassemble in single file on the common ribbon whose farther end is at the home nest, and the caravan, its hunger appeased, re-ascends to that nest.

“By day, even in winter, when the weather is fine, occasional distant expeditions are undertaken. The caterpillars crawl down the tree, reach the ground, and file off to a distance of perhaps fifty paces. It is not in quest of food that these outings are made, for the home pine-tree is very far from being exhausted, the stripped branches hardly counting in the great mass of foliage. Moreover, until night falls there is complete abstinence from eating. Hence we conclude that the insects are merely out walking for their health, or perhaps taking a little promenade to explore the country and search out suitable spots for burrowing in the sand when the time comes for their metamorphosis.

“Of course it is to be understood that in these excursions the conducting cord is not forgotten. Indeed, it is now more necessary than ever, and each excursionist contributes of the product of its spinnerets, as is the invariable rule in all these processions. Not one of the processionaries takes a step without attaching to the path the thread hanging from the marcher’s lip.

“If the procession is of some length the ribbon laid down becomes at last wide enough to find again easily; but, for all that, it is not found without hesitation. For let it be noted that the marching caterpillars never turn right about. This method of retracing their steps is utterly unknown to them. In order to regain the road already traveled they have

to describe a loop, whose windings and whose width depend upon the caprices of the file-leader. Accordingly there may be gropings and wanderings that occasionally last so far into the evening as to keep the company out all night. But that is no great matter; the caterpillars gather together in a compact group, motionless one against another, and the next day the search for the way home is resumed, with a successful issue sooner or later. Oftener than not the winding detour leads at the first attempt back to the conducting ribbon, and with this under the leader's feet all hesitation ceases and the company hastens homeward.

"In still another way this road of silk is evidently of service. As a protection against the rigors of winter the pine-tree caterpillar weaves for itself a shelter under which it snuggles in hours of storm and days of enforced idleness. If left alone to the meager resources of its silk-factory, the individual insect would hardly be able to protect itself in its exposed position at the end of a branch buffeted by the wind. A substantial shelter, proof against snow and sleet and harsh north wind, requires for its construction the united labors of many workers. Out of the slender contributions of each one singly the company makes for itself a roomy and durable abode.

"But this is not accomplished in a day. Every evening, weather permitting, additions and strengthenings are made. Hence it is essential that the band of workers should stick together until the cold season is past and the caterpillar stage is finished.

Without special precautions, however, the evening expeditions abroad in search of food would scatter the band; for at this time, with the cravings of the stomach calling loudly for satisfaction, there is a reversion to individualism, to the rule of every man for himself. Therefore the caterpillars become more or less scattered and isolated on the branches in the neighborhood, each one browsing its pine-needle independently. How are they to get together again and become a community once more?"

The answer has already been given. The individual threads all lead back to the common main thread or ribbon, which is more than a road; it is the social bond that unites the members of the caterpillar community. The formation and the leadership of the procession, with its habits and peculiarities, are next described:

"At the head of every procession, whether it be long or short, marches a file-leader or chief, though neither of these terms is strictly appropriate, as there is nothing to distinguish the foremost member of the marching company from those behind him. Chance and nothing else determines which one of the company shall lead the way; and that is all we can say about it. At any moment the leader for the time being may be supplanted by another, if the line is broken up by any accident and then formed again in a different order.

"But this temporary office imposes upon its holder a special character: whereas all the others passively follow him in an orderly line, he, the captain, bestirs himself and in brisk movements throws for-

ward the fore part of his body, now in this direction, now in that. At the same time that he is advancing he seems to be reconnoitering. Is he really exploring the region and seeking the best course to follow? Or is his hesitation caused merely by his having no guiding line to depend upon as he makes his way through strange regions? Those behind him proceed in all tranquillity, reassured by the thread they feel under their feet; but he is agitated, having no such dependence.

“Would that I might read what is going on under that cranium, black and shining like a drop of tar! From all appearances there resides in the tiny globe a very small measure of discernment that can distinguish, by making trial of the matter, the rough from the smooth, the powdery and unstable from the firm, and, more important than aught else, the threads left behind by those in front from the ground that is bare of such covering. There ends, or very nearly, what my long study of the processionaries has taught me concerning their psychology. Poor little brains, in truth, and poor little creatures whose community depends for its sole safeguard on a thread!

“The processions are of very variable length. The most imposing that I have seen going through its evolutions on the ground measured a dozen meters in length and contained about three hundred caterpillars accurately arranged in a wavy line. Such a line, even if composed of but two caterpillars, is always perfect in its orderly arrangement, the second caterpillar invariably touching the first.

Since the beginning of February I have observed in my greenhouse processions of all lengths. What tricks can I play on them? I see only two, the abduction of the file-leader and the breaking of the silk cord on which they march.

“The abduction of the file-leader produces no important result. It is a thing easy enough to do, but the procession continues on its way as if nothing had happened, the second caterpillar, now become the first, knowing in advance what it has to do in such an emergency; it determines the direction to be taken, or rather it hesitates and feels out the way.

“Nor does the rupture of the silk ribbon entail any consequences of much moment. From about the middle of the file I remove a caterpillar, and with a pair of scissors I cut away the section of ribbon occupied by it, taking care not to disturb the marchers before and behind. I clear away every trace of the ribbon at this part of the line. This break gives the procession two file-leaders instead of one, each independent of the other. It is possible for the second leader to rejoin the line that has been broken, the distance to cover being very short. If this is done, things resume their former condition. But it more often happens that the two sections do not become reunited, and in that event we have two separate processions wandering each at its own sweet will and getting ever farther apart. Nevertheless both will pick up the homeward-leading thread sooner or later by dint of wandering in all directions.

“These two experiments are of only moderate

interest, but I have devised a third that is richer in significant results. I propose to make the caterpillars describe a closed circle by cutting away the part of the ribbon that would lead them out of it. The locomotive follows its invariable line so long as there is no switch to divert its course. Will the processionaries, finding their silken route always open before them, persist in following a road that never comes to an end? To decide this question one must by artificial means create a closed circle, a thing unknown under natural conditions.

“The first device that occurs to one for attaining the end in view is to pick up the ribbon of silk with a pair of nippers somewhere in the rear of the procession and to carry the end carefully around until it meets the head of the line; then if the file-leader enters upon it the thing is done, for all the other marchers will follow after. But this manœuvre, though simple enough in theory, is very difficult in practice and produces no result of any account. Being extremely slender, the ribbon breaks under the weight of the grains of sand sticking to it when it is raised. And even if it does not break, the caterpillars in the rear of the line are liable to disturbance, no matter how much caution is observed, and this commotion makes them curl up or even let go their hold of the cord.

“Another and a greater difficulty presents itself: the file-leader will have nothing to do with the ribbon-end offered, the break apparently arousing the creature’s suspicions. Not finding it the same as the regular and continuous road, the leader

swerves to right or left and goes off on a tangent. If I intervene and try to conduct him back to the path of my choice, he persists in his refusal, doubles up, declines to budge, and confusion soon spreads through the entire procession. Let us then desist; the method is ill-chosen and calls for many vain attempts with only a doubtful success in prospect at the end.

“The thing to do is to meddle with the procession as little as possible and try to get a closed circle by natural methods. Is this possible? Yes, we can, without any intervention on our part, witness a procession of caterpillars marching over a circular route. This spectacle, well worthy of our serious attention, I owe to accident.

“On the bench where, in a bed of sand, the branches bearing my caterpillar-nests are implanted there are some large pots for holding palm-trees. These pots measure nearly a meter and a half in circumference at the top. The caterpillars often crawl up these pots to the broad rim running like a sort of cornice around the top. This rim seems to suit them for their processions, perhaps because of its firm surface on which there is no danger of any caving in, such as may occur in the sandy soil below; perhaps also by reason of its being perfectly level and thus offering rest to the processionaries after the fatigue of climbing up the pot. There, then, we have the circular route desired. All I have to do now is to await an opportunity favorable to my undertaking. I do not have to wait long.

“On the next to the last day of January, 1896, a

little before noon, I come upon a large company crawling up the pot and beginning to reach the spacious promenade at the top. Slowly and in single file the caterpillars scale the large pot until they arrive at the rim, around which they proceed in regular order, the circular procession being constantly added to by fresh arrivals. I wait for the line to close—that is, for the file-leader, in his progress around the broad circular rim to reach the point of entrance upon that rim. In a quarter of an hour this is accomplished and I witness the completion of the desired closed circuit, its form being very nearly a perfect circle.

“It now remains to remove the rest of the ascending column, which would interfere with the beautiful order of things and with the testing of my theory, as there would be too many marchers arriving and joining the procession. Furthermore, it is necessary to get rid of all silk threads, whether old or recent, that might put the rim in communication with the soil beneath. A paint-brush of good size is used for sweeping away the excess of climbers; and then with a coarse bristle brush I carefully scrub the outside of the pot, cleaning away all threads of silk attached to the surface in the insects’ march, and also removing any lingering odor that might perhaps later cause trouble. These preparations concluded, a curious spectacle awaits us.

“In the endless circular procession there is no longer any file-leader. Each caterpillar is preceded by another caterpillar and follows that other closely, guided by the silken track made by the marchers

ahead; and each caterpillar is followed by another, in close order and with the same precision. So it is all around the circle. No member of the procession is in command; or, rather, no member varies at will the route to be followed, but all move in unquestioning obedience to the supposed leader at the supposed head of the line, just as they would do under normal conditions. But this leadership has been done away with by my artful contrivance.

“With the first circling of the pot’s rim the silk cord is laid down, and it soon becomes a narrow ribbon as the procession continues with its constant additions of silk filaments. This track returns upon itself so as to form a circle with no branches leading off, my brush having destroyed all such offshoots. What will the caterpillars do on this deceptive path? Will they continue the unending round indefinitely until their strength is exhausted?

“The old scholastic philosophy has a story about Buridan’s ass, the famous animal that, on being placed exactly midway between two bundles of hay, allowed itself to starve to death from its inability to decide in favor of one or the other of the equally tempting bundles and so to upset the equilibrium of two equal but opposite attractions. The worthy animal has been slandered. No stupider than most others, the ass would have broken loose from the logical snare by eating both bundles. Will my caterpillars show a little of the same intelligence? After repeated trials will they be able to upset the equilibrium of their closed circuit, which now keeps them to a path that has no end? Will they make up

their minds to turn aside, this way or that, as the only means of gaining their bundle of hay, the green branch awaiting them only a step away?

“I believed they would, but I was mistaken. I said to myself that some time, in an hour or perhaps two, the procession would break away and would then discover how it had been tricked; the deceptive route would be abandoned and the descent would be made somewhere, no matter at what point. To remain there a prey to hunger and without shelter when nothing barred the way out, seemed to me a piece of incredible stupidity. But the actual facts compelled me to believe the unbelievable. Let us take up these facts in detail.

“On the thirtieth of January, toward noon, the weather being fine, the circular march begins. The processionaries proceed at an even pace, each caterpillar in touch with the one ahead and the one behind. In the unbroken circle there is no guide and hence no change of direction, but all follow mechanically the circular track, as faithful in this monotonous round as are the hands on the dial of a clock. The headless line has lost its liberty of action, its free will, and is now nothing but a machine. And so the march goes on for hours and hours, exceeding my utmost expectation. I am astonished; nay, more, I am dumfounded.

“Meanwhile the repeated circling of the caterpillars around the rim of the pot changes the silken cord into a splendid ribbon two millimeters wide. I can easily see it glistening on the dark background of the pot. The day draws to a close, and still there

is no disposition on the processionaries' part to deviate from their course in the slightest. A striking proof of this is worth noting. The path is not a perfectly level curved line, but a curve that at one point departs from the level, bending downward to the under side of the rim and then re-ascending to the original level two decimeters farther on. At the very outset these two points are marked with chalk on the pot. Well, all the afternoon and, more remarkable still, all through the days that follow until the end of the crazy dance, the line of caterpillars disappears under the rim at the first point and reappears at the second. With the laying down of the initial thread the route to be followed is unalterably fixed.

"But if the route is unchangeable, the rate of progress is not. This I find to be about nine centimeters a minute, on the average; but there are longer or shorter halts, and there are moments of slackened speed, especially when the temperature falls. At ten o'clock in the evening the movement is nothing more than a sluggish undulation of the body. A dead stop is near at hand, owing to the cold, to fatigue, and also, no doubt, to hunger.

"The hour for browsing has come. From all the nests in the greenhouse the caterpillars have issued in throngs to feed on the pine branches planted by me beside the silk nests. The caterpillars in the garden have also come out, for it is a mild evening. Those that are drawn up in line on the pot rim would gladly join the banqueters, for they must be sharp-set after their ten hours' walk. A fine green

branch beckons to them hardly a step away. To reach it they need but descend from their perch, and the poor simpletons cannot make up their minds to so bold a venture, but cling stupidly to their ribbon. I leave the starving creatures at half-past ten, believing that the night will bring wisdom and that by morning the old order will be restored.

"I am mistaken. I over-rated the caterpillars' mental powers in expecting the cravings of the stomach to arouse in the famishing insects some faint gleam of intelligence. At daybreak I pay them a visit and find them all in line as on the previous evening, but motionless. With the return of a little warmth they shake off their torpor, revive, and resume their march. The circular procession proceeds as before, with exactly the same mechanical precision.

"The following night is severe, the temperature falling abruptly, a change heralded in the evening by a refusal on the part of the garden caterpillars to leave their nests, despite appearances that to my dull senses indicated a continuation of the fine weather. At dawn the lines of rosemary are glistening with hoar frost, and for the second time that year ice is seen. The large pool in the garden is frozen over completely. What will the caterpillars in the greenhouse do now? Let us go and see.

"All are snugly ensconced in their nests except the obstinate processionaries on the rim of the flower-pot. Entirely without shelter, they appear to have passed a bad night. I find them disposed in two groups, with no sort of order. By thus huddling to-

gether and pressing one against another they suffered less from the cold than they would have otherwise. It is an ill wind that blows nobody any good. The rigors of the night have caused a break in the ring, so that there are now two sections—a condition that holds in itself some hope of salvation. Each section, when revived and once more on the march, will have a file-leader; and this leader, not being obliged to follow any other caterpillar, will have some liberty of action and will be able to divert the line from its beaten track. For let us not forget that in the usual processions of these insects the leader is also the scout of the party. While the others, unless there is something to derange the habitual order, keep strictly in line, the leader, attentive to the duties of a leader, continually turns its head this way and that, seeking all possible information, feeling out the way, and deciding what course to follow. The company obediently yields to the decisions thus reached. Let it be remembered, too, that even on a road already traveled and already carpeted with a ribbon of silk the file-leader continues to act as explorer.

“Thus there is reason to expect that the misguided caterpillars of the flower-pot will not be beyond the chances of rescue. Let us watch them. Having recovered from their torpor, the two groups gradually line up in two separate files. Will they succeed in breaking a way out of the charmed circle? I am for a moment inclined to think they will, but am soon undeceived. With a slight increase in the distance between one caterpillar and the next, the

two sections of the chain reunite and the circle is reformed. The file-leaders of a moment become once more mere followers, and again all the caterpillars march in a closed circuit.

“Another calm and starlight night brings a sharp frost. At daybreak the processionaries on the flower-pot, the only ones that have passed the night without shelter, are found gathered in one group, which extends considerably beyond the two edges of the fatal ribbon. I am present when the benumbed creatures begin to bestir themselves. The first one to get in motion happens to be outside the beaten track. Hesitatingly it ventures forward upon new territory. It reaches the very edge of the rim and crawls down the inside of the pot to the soil in the enclosure. Six others follow, but no more. Perhaps the remaining members of the company, not yet fully recovered from the torpor of the night, are too lazy to arouse themselves.

“This slight delay ends merely in a resumption of the former tactics. The silk ribbon is found once more and the circular march begins again, but this time with a break in the line. There is no attempt, however, on the part of the caterpillar thus made file-leader to vary the program. A chance is offered of leaving the magic circle at last, but the leader does not know enough to profit by it.

“As to the caterpillars that made their way down into the interior of the pot, their lot is hardly bettered. In a famished condition they clamber up to the top of the palm in quest of food. Finding nothing there to their taste, they retrace their steps by

following the thread of silk left behind them in their ascent, crawl up to the rim of the pot, find the procession there, and without more ado fall in and become a part of it. Once more, then, we have our closed circle and our endless line of march.

“When will deliverance come? There is a legend that tells of unfortunate souls drawn into a perpetual round that only a drop of holy water can break. What drop will happy chance throw upon my processionaries to break their circle and lead them back to the nest? I see only two ways by which their evil fate may be averted and they themselves set free from their charmed circle; and these are two painful trials. Strange linking of cause and effect: out of suffering, out of utter wretchedness, there may come some good.

“First we will take the benumbing effect of the cold. This makes the caterpillars group together in disorderly fashion, heaping themselves on the track and, still more, at both sides of it. Among those at one side or the other there may, sooner or later, be some revolutionary member who will boldly forsake the beaten track and strike out for himself in another direction, thus leading the company at last back to its home. We have just seen an example of something similar: seven caterpillars made their way into the inside of the pot and climbed the palm—an experiment that led to no result, it is true, but still an experiment. Entire success would have been assured had they chosen the outside instead of the inside of the pot for their exploring

expedition. One chance out of two means an even chance of success. Better luck next time.

“In the second place we have to consider the exhaustion produced by the long march and by continued fasting. There comes a time when some worn-out processionary is forced to halt from very weakness. In front the march still goes on for a little distance. There is a closing up of the file and a vacant space is left. Somewhat recovered, the halting member of the company, the one that caused the break in the line, becomes file-leader, with an open stretch ahead. The least inclination now to make a break for freedom would be enough to start the whole line upon a new path that might perhaps prove to be the way to safety.

“In short, to save the train from disaster it must be derailed, which is the reverse of the usual rule; and this derailment depends on the momentary caprice of a file-leader, the only one of the company in a position to turn aside, to right or to left. But there is no file-leader so long as the ring remains unbroken. At last a break occurs as the result of an accidental stoppage due chiefly to fatigue or cold. This occurrence, with its possibilities of rescue for the processionaries, is not infrequent, its principal cause being fatigue. In one day the moving circle breaks up several times into two or three sections, but continuity is soon restored and the state of affairs remains unchanged. The innovator bold enough to effect a rescue has not yet been found.

“On the fourth day, after a frosty night like those

that preceded, there is no change—nothing worth recording except the following. I had not, on the day before, removed the trail left by the few caterpillars that had crawled down into the inside of the pot; and this trail, branching off from the circular route, was discovered in the morning and made use of by a part of the company for visiting the enclosure and climbing the palm, while the rest of the band continued its course around the rim. But in the afternoon the section that had strayed away rejoined the main body, the circle was again filled up, and everything went on as before.

“Now we come to the fifth day. The night frost is still more severe, but does not yet penetrate into the greenhouse. A beautiful sun in a clear sky succeeds the frosty night, and as soon as its rays have infused a little warmth into the glass-enclosed space the caterpillars, now huddled in a heap, arouse themselves and resume their march. But this time the fine order observed in the beginning is disturbed, and a certain confusion is apparent, presaging a release in the near future, according to all indications. The explorers’ trail into the inside of the pot, a trail carpeted with silk in the two preceding days, is followed to-day by a part of the company for a short distance and then abandoned, while the remaining caterpillars continue on as before. As a result of this branching off there are two files of nearly equal length proceeding along the rim of the pot in the same direction and only a little space apart. The two lines rejoin occasionally and then separate again, always with some confusion.

“This confusion is added to by the fatigue of the marchers, many of them being so exhausted that they refuse to move on. Breaks in the line become more frequent, so that there are several sections, each with its file-leader feeling out the way and exploring the unknown. All signs point to an approaching general break-up with resultant salvation to the unhappy processionaries. But my hopes are again deceived: before night the unbroken single file is reformed and the interminable gyration resumed.

“As suddenly as cold overtook us, warmth now succeeds. To-day, the fourth of February, the weather is mild and clear. In the greenhouse there is great animation. Numerous companies of caterpillars have left their nests and are crawling in sinuous lines over the sand on the bench. On the rim of the flower-pot the circling processionaries break up and then reform their line again and again. But for the first time I note that a few bold file-leaders, intoxicated by the warmth and clinging with the hindmost pair of creepers to the rim, are reaching out into space with tentative twistings of the body. This operation is repeated many times, halting the march on each occasion. Heads sway this way and that with brusque movements, and bodies quiver. At last one of the bold adventurers decides to make the plunge and slips down under the rim. Four caterpillars follow, while the others, still pinning their hopes to the perfidious circle of silk, are too timid to risk the venture, and continue on as before.

“The short section detached from the main line feels about for some time, lingers long in hesitation on the outside of the pot, goes half-way down, then up again obliquely, and finally rejoins and once more merges into the circle on the rim. No success, therefore, this time, although at the foot of the flower-pot, only two spans away, there was a bunch of pine twigs that I had just put there as a lure to the starving processionaries. But neither the sense of smell nor that of sight told them anything. After so nearly reaching the object of their desire, the explorers returned to their former position.

“Never mind; the attempt will not have been in vain, for silk threads were laid down on the way, and these will lure other adventurers to fresh exploring expeditions. The route to safety is indicated by these first way-marks. And in fact, two days later, the eighth day of the experiment, the caterpillars, in groups and in short lines, and even one or two individuals at a time, crawl down the flower-pot along the route already marked out, and at sunset the last stragglers are in their nest.

“Now for a little calculation. Seven times twenty-four hours the caterpillars were on the rim of the pot. To allow for halts due to fatigue on the part of one or another of the processionaries, and for the hours of greatest cold at night when the march was necessarily suspended, let us divide the one hundred and sixty-eight hours by two and reckon the period of actual movement as eighty-four hours. The rate of progress averages nine centi-

meters a minute. Hence the whole distance covered is four hundred and fifty-three meters, or nearly half a kilometer—a pretty good journey for these slow walkers. The circumference of the pot at the rim is exactly one meter and thirty-five centimeters. Therefore the processionaries went over the course, always in the same direction and always to no purpose, three hundred and thirty-five times.

“These figures astonish me, familiar though I am with the stupidity of insects in general when by any chance they are thrown out of their customary routine. I am led to query whether my processionaries were not held in captivity so long rather by the difficulties and dangers of the descent than for lack of some gleam of intelligence in their poor brains. But the facts say that the descent is as easy as the ascent. The caterpillar has a very pliant back, well adapted for turning corners and making downward plunges. The creature proceeds with equal ease vertically and horizontally, with its back uppermost or underneath. Moreover, it does not advance at all until it has attached its thread of silk to the surface on which it is walking. With such a support grasped between the feet, there is no danger of a fall, whatever the caterpillar’s position.

“We cannot, then, suppose there was any fear of a misstep on the edge of the pot rim, this rim having been so easily mounted and so easily abandoned on several occasions. The processionaries, in distress and well-nigh starved, shelterless and benumbed, stick obstinately to the route traveled by

them hundreds of times before because they lack those first rudiments of reason that would tell them to abandon that route.

“Experience and reflection are meaningless terms as applied to them. They travel nearly half a kilometer and make three hundred and thirty-five turns of a circle without learning the first thing from the experience; and it is only chance that finally restores them to their nest. They would all perish on their deceptive ribbon of silk if the disorder produced by night encampment and by halts due to weariness did not cause some few threads of silk to be laid down outside of the circular path. These serve as lures to the passers-by, so that at last, in little parties and favored by chance, the whole company reaches the ground. To the school of scientific inquiry now in vogue, so eager to find the beginnings of reason in the lowest forms of animal life, I recommend a careful study of the pine-tree processionary caterpillar.”

Can we wonder now that Fabre refused to regard reason, intelligence, as merely one of the by-products of the struggle for existence?

CHAPTER XXV

THE MAN IN HIS WRITINGS

WITHOUT attempting a formal and tiresome enumeration of Fabre's various contributions to literature, let us pick out, here and there, a few sentences or paragraphs that reveal, vividly and strikingly, the very heart of the man. This revelation is something unexpected, because the treatises of a scientist are not supposed to throb with emotion or glow with warmth. Nevertheless the human quality of our naturalist is abundantly present in all the books he wrote, as it was in everything that he did and in all that he said. That is why he so charms and fascinates as a writer. Both young and old can find pleasure in his pages, whether they are designed primarily for youth or for more mature readers. The same simple, clear, engaging style marks them all, with only this difference, that in writing for older readers he makes more frequent use of Latin names for insects and plants than he would in preparing an elementary text-book; but this difference is so unimportant that virtually all his books can be confidently recommended to all readers.

In addition to the one great work from Fabre's pen, the "Entomological Souvenirs," in ten vol-

umes, there are nearly thirty others on various branches of science and designed especially for younger readers—many of them, in fact, written as school text-books and widely used in the lower schools of France. They were his main dependence for a livelihood during many years, and all they needed to increase and prolong their success in a commercial sense was some one to push them forward by modern publicity methods. With a little more exterior attractiveness, with better paper and printing and illustrating, and especially with more advertising, they need not have failed their author as they did to some extent in his last years. But the books are as modest in their dress, as unassuming in their appearance, as was their writer, though at present a handsome and well-illustrated edition of the “Souvenirs” is in process of publication.

A few passages taken almost at random will serve to illustrate Fabre’s manner of imparting a peculiarly human quality to his scientific treatises. In the fourth volume of the “Souvenirs” he takes occasion to acknowledge the help given him in his researches by his daughter Claire, who will be recalled by readers of “The Story Book of Science” as one of the characters in that pleasing narrative. Her father writes:

“Brought up among the various forms of animal life, the dear child has retained a vivid remembrance of our evening talks, in which insects were so often the theme, and her keen eyesight can distinguish, amid the things that chance presents to her view,

any item likely to be of service to me in my study of instinct."

An even more intimate glimpse of the naturalist's son Paul is afforded in the account of a certain dung-beetle known as the Sisyphus from its mode of pushing its pellet of provender before it as it proceeds to its hole, often meeting with the difficulties that confronted the classic Sisyphus in his stone-rolling task.

"It is very rare in this region," Fabre tells us, "and I never should have succeeded in obtaining a sufficient number for my purpose without the aid of a helper whom it is fitting that I should introduce to the reader, as he will appear more than once in these pages. This helper is my son Paul, a little lad of seven years. Constant companion of my insect-hunting expeditions, he knows, as does no one else of his age, the secrets of the cicada, the cricket, the grasshopper, and especially those of the dung-beetle, his favorite of them all. At twenty paces' distance his sharp young eyes distinguish, from among many chance heaps of earth, the one that indicates the insect's burrow. His alert ear catches the high-pitched shrilling of the grasshopper when to me all is silence. He lends me his eyes, he lends me his ears, and in return I give him ideas, which he receives with rapt attention, raising his big blue eyes to me in questioning gaze.

"Oh, what an adorable thing is the unfolding of the youthful intellect! how fair and lovely that early period when candid curiosity is awakened and shows

its eagerness to know all about everything! Therefore little Paul has his insect cage where the scarab performs its wonders; his little garden of the size of a pocket-handkerchief, where beans are sprouting dug up every now and then to let the gardener see whether the roots have yet started; and his nursery where may be seen four tiny oaks, a span high and with the cloven acorn still clinging to the stem. All this affords welcome diversion after the dry rules of grammar, though the grammar is coming on finely also."

Then follows a brief statement of Fabre's now well-known views upon the advisability and the practicability of making science interesting, even fascinating, to boys and girls. "What beautiful things," he exclaims, "science could show to these young learners if it would only relax its dignity and be friendly with the children, if our educational barracks would add to the dead study of books the living study of meadows and fields, if the stranglehold of prescribed courses so dear to the officials would not choke off every free and spontaneous impulse! Little Paul, my young friend, let us, so far as possible, pursue our studies in the open fields where the rosemary and the strawberry-tree will give us their company. Thus shall we gain strength of body and vigor of intellect; and we shall find there, far better than in musty books, the true and the beautiful."

Often in his studies of the insect world our naturalist pauses to indulge in moral reflections suggested by the struggles and the trials of his little

dumb friends. More often than not these reflections are tinged with some bitterness, his own struggles and trials being typified to him in the vicissitudes of insect life. Thus, in describing the habits of the Sisyphus, he recalls the ancient legend of the son of Æolus, punished for his wickedness by being compelled to push a huge stone up a hill, down which it always rolled as soon as it reached the top. He says:

“This myth appeals to me. It contains in brief form much that is true of us who are not odious reprobates, worthy of everlasting torments, but good people, industrious, and always ready to help our neighbors. One crime only is ours, poverty. For half a century and more I for my part have been pushing my stone up that hill, with bleeding hands and aching limbs; I have put forth all my strength, spent all my reserves of energy, in my efforts to lift to a place of security the burden that is crushing me, the burden of providing daily bread. But no sooner is the heavy load deposited in apparent safety than down it tumbles and goes hurtling to the bottom of the abyss. Begin again, poor Sisyphus, begin again and keep at it until your crushing burden, falling for the last time, dashes your brains out and so finally frees you from your thralldom.”

How much of this is rhetoric and how much a true account of actual hardship, who shall say? Fabre was a literary artist, and he had, as he would have expressed it in his own language, *les défauts de ses qualités*.

Our entomologist's habit of introducing the most intimate personal and domestic details into his insect studies gives pleasing variety to his pages; it adds a warmly human touch and makes the reader conscious that it is no dry-as-dust scholar behind those pages, but a living and breathing, suffering and rejoicing fellow-creature. In his account of the strawberry-tree caterpillar and its snug little nest of leaves, the naturalist discloses to us one of the domestic infelicities that afflict him:

“When we wish to keep out the wind we apply weather-strips to windows and doors. The caterpillar of the strawberry-tree, luxurious little creature, uses strips of silk velvet. It must be snug and dry in there, however damp and foggy outside. In bad weather the rain leaks into my house. The house made of leaves knows no such vexatious invasion of the elements, so far superior to human contrivances are, not infrequently, the insect's resources.”

Studying the habits of a certain flesh-eating maggot, Fabre indulges in this lamentation:

“Many secrets are still hidden from us, but with the necessary optical aids one might gain very valuable knowledge concerning this maggot. I myself would gladly have pushed my investigations farther if I had possessed the requisite appliances; but I have not now, I never have had, and beyond a doubt I never shall have the resources so essential to research work. They fall to the lot of those clever ones only who give more thought to lucrative positions than to beautiful truths. However, let us con-

tinue as far as the slenderness of my means will permit."

But with all the pinching and self-denial imposed by poverty on the man who devotes himself to the pursuit of truth rather than to the getting of money, the intellectual life is still well worth while, as Fabre repeatedly and high-heartedly maintains. A paragraph from the third volume of the "Souvenirs" strikes this loftier note:

"It is late. Enough for to-day. I am worn out, but amply repaid for my labors by a shattered cocoon and the fragments of a poor little worm's skin. My young readers, you who are interested in natural history, do you wish to know whether the sacred fire runs in your veins? If you do, imagine yourselves returning from such an expedition as this of mine. You carry over your shoulder the heavy farm implement of a peasant, your back aches from long delving in the earth in a stooping posture, the heat of an August afternoon has started your brains to boiling, or so it seems to you; your eyelids are sore from the irritation caused by the glaring sunlight, you are consumed with thirst, and before you stretches kilometer after kilometer of dusty road that must be traveled ere you can rest your weary limbs. Nevertheless your heart sings within you, and, forgetting your present sufferings, you are happy. Why? Because you are the possessor of a shred of rotten skin. If this is really the way with you, my young friends, press on, you will reach your destination; but never by this route, I warn you, will you arrive at worldly prosperity."

Repeated instances occur in Fabre's writings in which he draws a moral lesson, in a manner all his own, from the habits of some insect, from the modest dress of some tiny creature of the field or garden, or even from inanimate objects to which his talk may have led. Engaged in the study of a certain digger-wasp, he takes occasion to remark:

"Its solitary habits, its peaceful occupancy of any chosen spot—these account for the silence of history concerning this insect. So modest and discreet are its ways that its presence is hardly ever noticed. Renown is to the noisy, the pushing, the destructive." In like vein he exclaims, with reference to certain other unobtrusive insects: "Long live the modest! Long live the little!"

Another illustration of this moralizing tendency, which after all he never carries so far as to render it tiresome, may be found in his talks on chemistry to his children, as recorded in "The Wonder Book of Chemistry." Referring to the comparative usefulness of the elements most familiar to us all, he gently chides Emile for attaching so much importance to gold.

"You are all astray, my dear Emile," he says, "on this subject of importance. . . . In the general scheme of things gold plays only an insignificant, almost a negligible part. If it were lacking altogether, the order of nature would not be affected. Oxygen, hydrogen, and nitrogen, on the contrary, fulfil in this world of ours functions so important that if any one of these three were taken away, everything would be turned topsyturvy and life

would be rendered impossible. To these three, carbon must be added, for its part is not less important; and thus we have four substances indispensable to all life, vegetable as well as animal. Now compare with them, if you please, this gold that everybody talks about, is familiar with, longs for, and that many wear themselves out in trying to get. Was I not right when I said that making the most noise in the world is a very different thing from rendering the highest service? Believe me, my young friends, gold is but a poor thing when looked at from the proper point of view."

Against the temptation to spin beautiful theories with too little regard for actual facts Fabre is ever on his guard. Repeatedly he takes occasion to score the Darwinians, the evolutionists, the advocates of this or that plausible system constructed in the seclusion of the study or among the dusty books of the library. "Books," he declares, "inspire in me but little confidence." Not in them does he find "the holy joys of truth." When he does read he never forgets that, as he expresses it, "the last word of wisdom is doubt." In a passage remarkable for its apt imagery he says: "However delightful it may be to soar on the wings of the imagination, it is better to prefer the sandals of observed facts, the slow sandals with soles of lead. I will now put them on and continue my narrative."

CHAPTER XXVI

THE FABRE JUBILEE

THAT the hermit of Sérignan, the obscure student of insect life, would ever become famous enough to have a celebration in his honor, a celebration dignified with the name of "jubilee," would have seemed incredible to him during those years of patient and unrecognized toil in the cause of science. Nevertheless there came at last some sort of awakening to his worth and his services. Foreign learned societies had long since put his name on their list of honorary members, and the scholars of his own country tardily became aware of his remarkable contribution to the science of entomology. But before this rather inadequate recognition arrived he had sounded the depths of that depression which comes to all faithful toilers whose honest and earnest efforts in a worthy cause bring them almost no returns in either fame or fortune. How, on the other hand, was he to become known? In a letter to his brother in 1903 he declared his attachment to his quiet and obscure retreat.

"The outside world," he wrote, "hardly tempts me. Surrounded by my little family, I am content to go occasionally into the woods and listen to the chorus of the blackbirds. The bare thought of the city repels me. It would be impossible for me now

to live in the little cages in which city folk pass their lives. Here I am, and here I shall stay to the end, a veritable savage."

Work, however little it brought to him of material gain or appreciative recognition, was his stay and his solace. "Fie on your life of ease!" he exclaims. "There is nothing like work for keeping one in the right way of living, as long as the machine is able to run." In his opinion work is "the sovereign consoler of the afflicted, both human and animal." But work that produces no results, no income to the worker and no word of sympathetic approval, is extremely fatiguing. It is like beating the air. Fabre's series of elementary text-books had at first been very favorably received, they had been adopted for use in the lower schools of France, and they yielded him for some years as much as sixteen thousand francs annually.

But times changed. The fashion in school-books took a turn that left those modest volumes stranded on the booksellers' shelves. The anti-clerical movement (the opposition to church and clergy) helped to make them no longer acceptable in the schools because their devout author had inserted occasional mention of the Deity, had occasionally ascribed the wonders of the universe to a divine author. School inspectors of the anti-clerical faction frowned upon this mixing of things spiritual with things temporal; or, rather, things spiritual had for them no existence. From 1894 onward the excellent little lesson-books that had at first met with so cordial a welcome fell into increasing disrepute, which, how-

ever, appears at present to be giving way to a reaction in their favor, or at least to a widening popularity in the larger book world to which they have lately been introduced. This reaction is something for Fabre's admirers to rejoice in, even though the master himself did not live to be cheered by it. He wrote to his publisher in 1899:

"Despite all my efforts I am more than ever anxious for the future. Two more of my books are ceasing to circulate—a prelude to total shipwreck. Despair is beginning to take hold of me."

With many calls on his purse, which seems to have been freely open to all having any sort of claim upon it, he had not saved up anything for a rainy day. His first wife had not distinguished herself for thrift, but rather the reverse, it appears. The "Souvenirs" brought him in but a scanty revenue, their author being still too little known to ensure their sale. He knew that he had put of his very best into these volumes, and that they were worthy of a wide circulation. In a tone of pardonable bitterness he wrote to his brother, in 1900:

"A work such as Réaumur would have been proud to claim as his own will leave me a beggar,—that is a matter of course,—but at least I shall have contributed my grain of sand. Long ago I should have thrown the helve after the ax-head had I not had, for my encouragement, the consciousness of being engaged in the continual search for truth in the little world of which I had made myself the historian. I gather ideas and struggle along as best I can."

Meanwhile, not many miles away, at Maillane in this same beautiful land of Provence, the poet Mistral, seven years younger than Fabre, was enjoying fame and prosperity in abundance. Both men belonged to the peasant class of southern France, and both were loyal lovers of that sunny land and haters of city crowds and city ways. They saw little of each other, it is true, but each felt himself drawn to the other and akin to him in simple tastes and in the love of truth. Mistral visited Fabre in 1908 and was among those who, however tardily, exerted themselves to have some sort of worthy tribute paid to the great naturalist, by his countrymen and by representatives from foreign lands. A letter from Fabre to Mistral at about this time reveals, in a pathetic way, the straits to which the hermit of Sérignan was reduced and his hope that Mistral might be able to help him. He proposed to sell to some museum of natural history his fine collection of water-color paintings of the mushrooms of Provence. These were the work of his own hand, and it almost broke his heart to think of parting with them. But he needed the money. Luckily the sacrifice was not required of him, as things turned out. His friends and admirers rallied to his support, prizes and pensions were awarded him, and the water-colors were saved to enrich the future Fabre Museum after the owner's death. The letter, however, loses none of its interest.

"It had never been my purpose," wrote Fabre to his poet friend, "to derive profit from my humble mushroom water-colors. . . . But fate will perhaps

decree otherwise. . . . In this connection let me make a confession, encouraged thereto by your nobility of character. Until lately I had enjoyed a modest livelihood from my school-books. Now the educational whirligig has turned in another direction and my books no longer sell. Hence I am as much as ever at grips with the terrible problem of how to provide the bread for each day's needs. If it should seem to you likely that through your influence and that of your friends my poor pictures might be made contributory to my support, I am prepared to part with them, but not without extreme reluctance. It will be like giving up a piece of my own skin, and I am still attached to this old skin of mine, shabby though it is, my attachment being a little for my own sake and much more for my family's, as well as for the sake of my entomological studies, which I should like to continue, being persuaded that for a long time no one else will take it into his head to do this work, so thankless is the task."

This letter appears to have aroused the poet to the need of doing something for his friend. At his instigation the prefect of Vaucluse undertook to interest the government in the impecunious naturalist, and the result was a grant of one thousand francs "for the encouragement of science." Finally Mistral went before the General Council of Vaucluse and pleaded Fabre's cause so eloquently that an annual donation of five hundred francs was made to the naturalist "as a tribute of homage from his

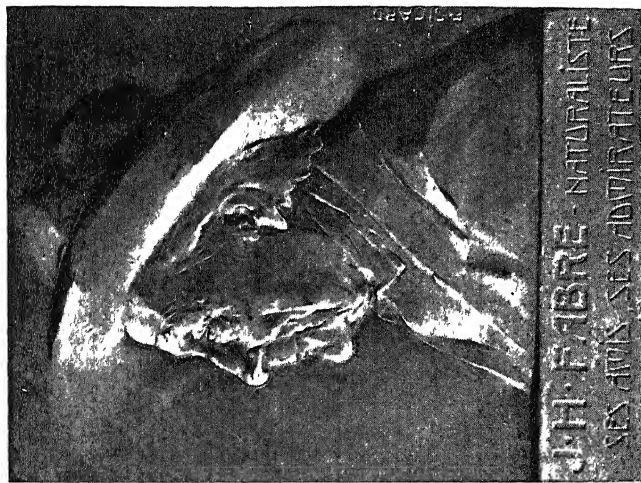
compatriots to his great learning and his excessive modesty."

The same body had, at its previous session, placed at the naturalist's disposal the entire equipment of the departmental laboratory of agricultural chemistry, which had fallen into disuse and was on the point of being done away with altogether. Thus, by one of life's little ironies, when his course was almost run, his task almost completed, everything in the way of help and appliances seemed about to come to the aged scholar. But of what use was all this chemical apparatus to him now? He had learned to do without such things; he did not even own a thermometer, it is said, and his only valuable possession was a microscope given to him by the chemist Dumas at the instigation of Fabre's old-time benefactor Duruy. Could this costly equipment now bestowed upon him have been of any real help if it had come earlier? It is doubtful, for, as Fabre himself has said, "the secrets of life are revealed to those who use but the simplest implements, tools improvised for the occasion and costing nothing. What have the best results of my researches on instinct cost me? Nothing but time and, still more, patience."

At this point in his long life of humble and unregarded effort to add to human knowledge, his friends determined that he should no longer remain unknown. They would rally around him and make his name famous. It was high time. A little later and "the fiddles would have come too late," as he

expressed it. For his sight was failing him, his hands trembled so that he could hardly write his name, and his step was so feeble that he required a supporting arm on one side and his cane on the other. No more walks about his garden and grounds now; the paths that he had trod for thirty years knew him no longer. Yet he was no melancholy wreck. He was cheerful, though overcome with weakness, and he was still interested in the things that had always interested him, though regretfully forced to abandon his insect studies. Regret, indeed, he felt at not being able to carry his "Souvenirs" to the point fixed by him in advance; but he had given to the world ten goodly volumes of those wonderful reminiscences, and how could much more have been expected of him?

The celebration, the "jubilee," as his friends called it, was held on the third day of April, 1910, at his own home and in the dining-hall of the local restaurant. Government representatives and delegations from home and foreign learned societies gathered about him and paid him homage. From the Academy of Sciences a gold plaque, designed by the artist Sicard and bearing on one side the naturalist's portrait and on the other an allegorical composition, was presented to "the Homer of the insects," as Victor Hugo had called him, "the Virgil of the insects," as Edmond Rostand afterward styled him. From the Royal Academy of Stockholm there came to him the Linnæan Medal. The French Academy awarded him, a little later, the



THE FABRE JUBILEE MEDAL STRUCK IN 1910

Photographed by J. G. Pratt from the medal in the possession of Dr. L. O. Howard

largest of its money prizes and recommended him for a Nobel prize.

The banquet with which the celebration closed was an informal love-feast in the village restaurant, whither the hero of the day was conveyed in a festive landau summoned from Orange for the purpose. The object of all these attentions was literally overcome; he wept with emotion, and many of those about him wept also.

Of the letters read aloud on this occasion from eminent men unable to be present in person, there is here space to reproduce but one. Romain Rolland wrote:

You do not know how much pleasure you have given me by inviting me to join you in paying tribute to J. H. Fabre. He is the one Frenchman whom I admire above all others. The ardor and the patience shown in his genial observations charm me as I am charmed by the masterpieces of art. For years I have been a reader and a lover of his books. In my late vacation, out of three books that I took with me on my journey, two were volumes of his "Entomological Souvenirs." You will do me an honor and give me great pleasure by counting me as one of your number.

Let this chapter close with a brief reference to the humble admirer whom Fabre himself must have been most pleased to see with those gathered about him on that memorable day. Men in exalted office and men in high academic chairs were no more to him than the faithful and true of his own humble life and daily walks. Accordingly he valued the

speechless tribute offered him by Marius, the blind cabinet-maker, as highly as the most polished utterances of fluent spokesmen from learned societies and royal academies. So long had Marius waited, fearing lest he should have to wait in vain, for this day of glory to dawn on the hermit of the *Harmas*, the sage of Sérignan!

CHAPTER XXVII

THE PEACEFUL END

OUR naturalist's busy and fruitful life was drawing to a close. In 1912 his second wife died, in 1913 his brother was taken from him, and in that year also his youngest son, the "little Paul" with whom the reader will by this time feel himself pretty well acquainted, was married, though not lost to him, as either then or not long afterward the young couple appear to have established themselves with the now nearly disabled patriarch. A recent visitor at the *Harmas* reports that one of the daughters by the first marriage, Aglaé, and Paul Henri are the only ones of the naturalist's children still remaining under the paternal roof. The poet Mistral lingered until a few months before his friend at Sérignan was summoned, but the two were unable in those closing years to exchange visits.

Naturally enough, the great problems of life and eternity claimed some share of the old scholar's thoughts at this period. To two professors from the Grand Séminaire de Saint-Paul-Trois-Châteaux who came to see him he said, referring to their holy calling, "You have chosen the better part," and presently added: "Life is a horrible phantasmagoria, but it leads to a better future." In that future he liked to think that he should find again

the things that had delighted him here—the incense-breathing flowers, the cheerful crickets and cicadas, and the singing birds, “those little choristers, trilling their melodies to the glory of Him who gave them voice and wings on the fifth day of Genesis.” To the very last his delight in birds and flowers, so far as he retained the ability to enjoy them, continued unabated.

But the terrible shock of the great war into which his country was plunged in his ninety-first year, told on his courage and strength. The invasion of 1870 had moved him to bitter reflections, and this far more terrible devastation must have been crushing to his little remaining vitality. But he was not to see or to learn the worst of it. In the summer of 1915 his weakness increased to such a degree that hope of his rallying was given up. The village priest had been swept into the vortex of the horrible strife, and it was only by chance that a member of the clergy from Brittany was at hand to render the spiritual assistance so gratefully accepted by the dying man.

With the calmness and fortitude befitting so great a soul, Fabre drew his last breath on October 11, 1915. The funeral, simple and appropriate and in all respects as he would have wished it to be, took place five days later, with the Archbishop of Orange officiating. On his tomb in the little churchyard of Sérignan one may read the brief epitaph composed by himself:

Quos periisse putamus
Praemissi sunt.

Minime finis, sed limen
Vitæ excelsioris.¹

It would be unfair to this lifelong truth-lover and truth-seeker to leave the impression that he stood in unchallenged preëminence in his domain of nature-study. The evolutionists, naturally enough, criticised him for his unqualified rejection of their theory; and no fair-minded observer can quite acquit him of some tendency to dogmatism in his views. Darwinism came into vogue when his mental habits were already formed, and with advancing age he did not become less set in his ways of thinking. Nevertheless, his refusal to accept evolution as the key to the riddle of existence was a useful and needed protest against a prevalent tendency to make mechanical laws account for the wonders of a universe that is surely not less spiritual than material.

Another criticism of Fabre's work has to do with his accuracy and faithfulness as an observer of insect habits. His compatriot, the entomologist Ferton, has pointed out in Fabre's writings certain instances that in this critic's opinion amount to errors of statement, with some alleged betrayals of ignorance respecting the work of other entomologists. But who of us is infallible? Even the severest of Fabre's critics acknowledge the inestimable value of his observations as a whole and the unrivaled charm of his style as a writer.

Fabre's great service to natural science lay in his

¹ "Those whom we think to have passed away are but gone before. This is by no means the end, but the threshold of a higher life."

being the first to study, with such notable results, the living insect, and to learn the secrets of its busy life. A museum of dead specimens meant nothing to him, as it means nothing to most of us; but the living and active little creatures were his fellow-beings, and he loved them. To them he professed to owe, as he expressed it, "the rare moments of happiness my life has afforded me." The study of them was to him literally an endless delight; for as Darwin declared that no one human life would suffice to exhaust interest in the study of earth-worms alone, so Fabre well said that "human knowledge will be erased from the world's archives ere we know the last word concerning a gnat."

In concluding our review of this man's intellectually and spiritually eventful life we are filled anew with wonder that such a genius could have sprung from such an ancestry and such an environment. He was a splendidly unaccountable freak of nature. As we find no one among his forebears who in the slightest degree approaches him in respect to mental endowments and striking originality, so we find no one among his descendants now living who can be compared with him in these respects. Nature cast him in a special mold and then broke the mold.

A natural query that arises after reading Fabre's self-revealing and warmly human reminiscences is this: Could one thus highly inspired have been really as wretched as he represents himself to have been in his struggle against adverse circumstances? Who shall say? At the moment of these complaints he undoubtedly felt the hardness of life, as we all

do at times; but these moments of discouragement and depression were not, after all, of so very much consequence in comparison with the hours and days of high-hearted endeavor and thrilling achievement through which they were sparsely scattered. In fact, those who pretend to know say that for many years Fabre enjoyed an adequate income, and that it was only his own incompetence in domestic economy that made his lot in life seem less easy than might have been desired. Perhaps the truth in this as in so many other debatable questions lies midway between the two extremes of opinion on the matter. At any rate, much as we admire uncomplaining endurance of misfortune, we could not have learned to know this interesting and lovable man as we now know him if he had been a stoic instead of an occasionally self-pitying and amiably fretful human being. Let us, then, be thankful that he now and then yielded to the temptation to express his woes in writing, to let off steam in a blast of harmless rhetoric. Carlyle was fond of grumbling, and professed to believe himself the most wretched of mortals; but both Carlyle's and Fabre's lamentations have rather too much of the rhetorical in them to draw our tears. We feel that they experienced an artist's enjoyment in painting their woes, and we do not begrudge them the relief that came to them from this self-expression. We all feel better when we have succeeded in putting our grievances into a telling phrase. It is a safety-valve.

But after all is said, Fabre's life was no easy one; his deeply lined face tells us that. Yet it still

remains true that an easier life might not have—indeed, could not have—given us the Fabre we now know, the Fabre of the “Souvenirs” and of the many popular manuals of elementary science, whom it has been the purpose of this book, to present to the reader.

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